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Message from the Editor-in-Chief

Dear Colleagues,

TOJSAT welcomes you. TOJSAT would like to thank you for your online journal interest. The online journal system has been diffused very fast for last eight years. TOJSAT has continued to diffuse new trends in science and technology to all over the world.

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TOJSAT thanks and appreciate all reviewers who have acted as reviewers for one or more submissions of this issue for their valuable contributions.

TOJSAT, TASET, Governor State University & Sakarya University will organize ISTEC-2018 (www.iste-c.net) between July 18 - 20, 2018 in Paris, France. For any suggestions and comments on the international online journal TOJSAT, please do not hesitate to send mail.

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Aptil 01, 2018
Prof. Dr. Aytekin ISMAN
Editor-in-Chief
Sakarya University

Message from the Editor

Dear Tojsat Readers,

Now, we have approached 2nd issue of 8th volume of The Online Journal of Science and Technology. We finished the istec 2017 conferences hold in Berlin, Germany and Harvard University, USA. The papers submitted from Korea to Turkey receives interests from all over the areas of science and technology. The selected, peer-reviewed papers were accepted for publication apart from contributions from all over the World.

Prof.Dr. Mustafa S. Dündar

Editor

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A CASE STUDY OF AN ANAEROBIC DIGESTER STRUCTURE

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Abstract: A wastewater treatment plant named as Kızıltepe Wastewater Treatment Plant, construction area is located at the city of Mardin and district of Kızıltepe. The purpose of this study is to design the deep foundation system composed of vertical pile elements for the anaerobic digester structures planned to build in the construction area of Waste Water Treatment Plant. The pile group designed is subjected to vertical and lateral loads. The weight of the digester structure, waste weight containing in the digester structure and the foundation weight have been considered as vertical loads. However, the wind and earthquake loads have been taken into account as lateral loads. The experimental studies both laboratory and in-situ have been performed to obtain the geotechnical parameters which are necessary for the design of the foundation system of anaerobic digester structures. The boring logs including N values obtained from Standart Penetration Tests (SPT) and results of the laboratory studies belonging to the borehole drilled in the anaerobic digester structures construction area have been used for this study.

Keywords : deep foundation, pile group, bearing capacity, lateral load.

Introduction

Pile as a structural element commonly are employed to overcome the problems like low bearing capacity of subsoil layers, high values of overturning moments, considerable subsidence and etc. However, since the very early stage of geotechnical engineering profession, estimation of the bearing capacity of piles had been a challenge for engineers (Karimpour-Fard & Eslami, 2013).

Pile foundations are extensively used to support various structures built on loose/soft soils, where shallow foundations would undergo excessive settlements or shear failure. These piles are used to support vertical loads, lateral loads, or a combination of vertical and lateral loads. However, in view of the complexity involved in analyzing the piles under combined loading, the current practice is to analyze the piles independently for vertical loads to determine their bearing capacity and settlement and for the lateral load to determine their flexural behavior (Karthigeyan, Ramakrishna & Rajagopal, 2007).

The main object of this study is to design the foundation system composed of vertical pile elements for the anaerobic digester structure. As a first step, the pile group designed is subjected to vertical and lateral loads. The weight of the digester structure, waste weight containing in the digester structure and the foundation weight have been considered as vertical loads. Also, the wind and earthquake loads have been taken into account as lateral loads.

The boring log, N values obtained from Standart Penetration Tests (SPT) and results of the laboratory studies have been used in the preparation of this study.

Site Conditions

One borehole was drilled in the anaerobic digester structures construction area. The depth of borehole was about 30.0 m. Laboratory test results performed on the specimen obtained from the borehole BH7 and the SPT-N values belonging to this borehole (S7 in Turkish report) have been used while preparing this study. The layout of the wastewater treatment plant and locations of the soil borings performed in construction area have been shown in Figure 1.

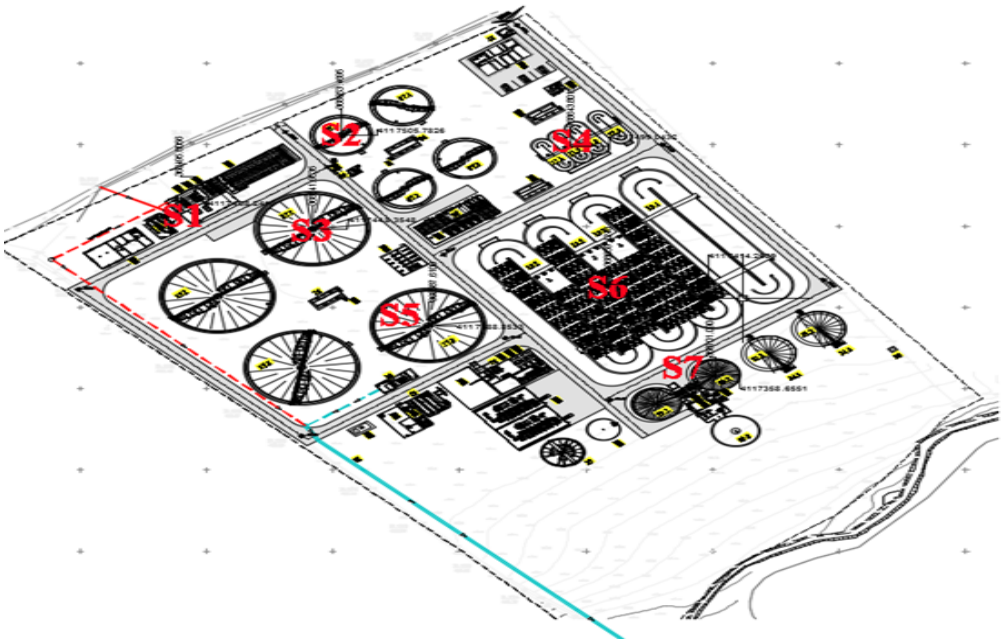

Figure 1. The layout of the Wastewater Treatment Plant and Locations of the Soil Borings

The N_{30} values obtained from Standart Penetration Tests (SPT) for corresponding depths have been summarized for the borehole BH7 in **Table 1**.

The soil profiles encountered in the field has been given in below for borehole BH7.

BH 7 (Boring Log)

0.00 – 0.50 m	Vegetable Soil
0.50 – 30.00 m	Sandy Silty CLAY

The groundwater level was encountered at the depth of **-13.0 m** in the boring.

Table 1. SPT N_{30} Values

Depth (m)	*SPT-N_{30}*	Depth (m)	*SPT-N_{30}*
1.50	*16*	**16.50**	*R*
3.00	*22*	**18.00**	*R*
4.50	*21*	**19.50**	*R*
6.00	*26*	**21.00**	*R*
7.50	*34*	**22.50**	*R*
9.00	*43*	**24.0**	*R*
10.50	*45*	**25.50**	*R*
12.00	*46*	**27.00**	*R*
13.50	*61–R*	**28.50**	*R*
15.00	*58-R*	**30.00**	*R*

The Vertical and Lateral Load Capacities of A Vertical Pile

Pile foundations for buildings and bridges are often subjected to vertical and horizontal loads simultaneously. Yet, the axial and lateral responses of piles are often evaluated separately without considering their possible interactions (Zhang et al., 2002).

Behaviour of single pile under uplift load is well established and classical solutions are available for estimating the uplift load carrying capacity of pile. But, piles are installed in group in general (Ayothiraman & Tank, 2010). In this study, the pile group designed is subjected to vertical and lateral loads. The weight of the digester structure, waste weight containing in the digester structure and the foundation weight have been considered as vertical loads. However, the wind and earthquake loads have been taken into account as lateral loads.

Design methods for piled foundations still concentrate on providing axial capacity from the piles to carry the total structural load (de Sanctis & Mandolini, 2006). The total load has been taken into as equal to **87000 kN** in this study. The base of the pile will have been on the layer which has a SPT N value greater than 50. Therefore, it is not expected settlements which are significantly large.

The Vertical Load Capacity of A Vertical Pile

The axial load capacity of the single vertical pile has been calculated as indicated in below (Table 2).

Table 2. The Axial Load Capacity of the Single Vertical Pile

	c (kPa)	L (m)	ϕ (cm)	Q_f (formula)	Q_f (kN)
1	80	4.50	80	$Q_f = A_s * \alpha * c_u$	**507.00**
2	150	6.00	80		**905.00**
3	200	4.50	80		**860.00**

Q_f = ultimate friction load or skin load
A_s = total surface area of pile embedded below ground surface
c_u = average undrained shear strength of clay along the shaft
α = adhesion factor
ϕ or D = diameter of pile
L = length of pile

The axial load capacity of the single vertical pile has been calculated as indicated in below [7].

$Q_b = (c * N_c * A_b) = 200 * 9 * 0{,}503 = \mathbf{905{,}0\ kN}$ (the base or point load) (1)
$Q_a = (507{,}0 + 905{,}0 + 860{,}0 + 905{,}0)/2{,}5 = \mathbf{1271{,}0\ kN}$ (allowable total loads) (2)

The axial load capacity of the pile element has been chosen as equal to the **Q_a = 1270 kN.**

The pile length, diameter and spacing of the pile centers are summarized in below:

- L = 15 m D=80cm S=2.40 m = 3D

The pile number in the pile group has been calculated as the ratio of total load / axial load capacity of a pile.

Number of the pile in the pile group = 87000 kN / 1270 kN = **69**

The piles will be placed beneath the foundation of the digester structure with the grid of **2.40 m x 2.40 m.**

The distance between the centers of the piles is equal to **3D**.

The Lateral Load Capacity of A Vertical Pile

Pile foundations are generally preferred when heavy structural loads have to be transferred through weak subsoil to firm strata. These foundations in some situations are subjected to significant amount of lateral loads besides vertical loads (Juvekar & Pise, 2008). In order to that, amount of lateral loads must have to known by researchers. The lateral load capacity of the pile element has been calculated using the method proposed by Broms. The smallest lateral load capacity value calculated for the cases mentioned above has been chosen as the lateral load capacity.

$$M_y = \frac{f'^c * I}{h} \quad (3)$$

For C30 concrete, $f_{ck} = 30\ MPa = 30000\ kN/m^2$,

$$I = \frac{\pi * R^4}{64} = \frac{\pi * (0.8)^4}{64} = 0.02011 \quad (4)$$

$$M_y = \frac{30000 kN/m^2 * 0.02011\ m^4}{0.40} = 1508.25\ kN \quad (5)$$

c=100 kPa L=15.0 metre Ø80 cm e=0

$$P_{ult-1} = \frac{M_y}{0.5L + 0.75b} = 845\ kN \quad (6)$$

$$P_{ult-2} = \frac{2M_y}{1.5b + 0.5f} = \frac{3016.5}{1.5 * 0.80 + 0.5 * 2.40} \cong 1256\ kN \quad (7)$$

The minimum $\rightarrow \boldsymbol{P_{ult} = 845\ kN}$ *are chosen.*

$$P = \frac{845}{3.0} = \boldsymbol{281\ kN}$$

Conclusions

In this study, the total load is about equal to 87000 kN. The axial load capacity of a single vertical pile has been calculated as 1270 kN. Number of vertical pile are 69. The lateral load capacity of the pile has been calculated using the method proposed by Broms and are chosen according to the smallest value. The smallest lateral load has been calculated 845 kN. Safety factor is taken 3.0 in this study. Allowable lateral load is about to equal to 281 kN.

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A NEW HYBRID DECISION MAKING MODEL TO OPTIMIZE MACHINING OPERATIONS

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Abstract: Multi criteria decision making models (MCDM) are extensively used in material and process selection in engineering. In this study, a novel hybrid decision making model is developed. Best-Worst (BWM) and entropy methods are combined and hybridized with Reference Ideal Method. The model is tested in a face milling case study taken from literature. The developed model produced similar results with literature. The proposed model can be used by engineers and operators in manufacturing environment.

Keywords: Multi criteria decision making, Best-Worst method, Reference Ideal Method, Micromachining, face milling

Introduction

In recent years, there has been an increasing amount of literature on MCDM. When the studies in literature are investigated, MCDM techniques are grouped under 15 topics: Energy-environment-sustainability, supply chain management, material, quality management, Geographic Information Systems (GIS), construction and project management, safety and risk management, manufacturing systems, technology management, operation research and soft computing, strategic management, knowledge management, production management, tourism management and the other fields (Mardani et al., 2015). For MCDM techniques, there are a lot of studies in the area of material science (Jahan et al., 2011) production technologies (Streimikiene et al., 2013), mass production (Chang et al., 2013), manufacturing sector (Bagočius, 2013) manufacturing systems (Jana et al., 2013), global production (Tzeng and Huang, 2012) and production strategies (Yurdakul, 2004).

One of the new methods developed in recent years is Best-Worst method. This method provides to score only best and worst criteria. Therefore, pairwise calculations are only between best and worst criteria and calculations are simple. Furthermore, it is more consistent than AHP method. Reference Ideal method is another new MCDM method to rank the alternatives by using subjective decision matrix. Entropy method is an objective weighting method to determine criteria weights. By using this method, the entropy weights are calculated by using the information entropy (Razaei, 2015; Cables et al., 2016; Li et al., 2016).

Up to now, for MCDM techniques, previous studies are generally carried out in Operation Research-Soft Computing and energy-environment-sustainability. In machining operations, researchers rarely developed MCDM models. Furthermore, developed model in this study is a new hybrid decision making model and it is used for the first time in the literature.

In this study, Best-Worst and Entropy methods are combined and hybridized with Reference Ideal Method. The proposed model is tested in a face-milling operation. The criteria weights are calculated by using Best-Worst and entropy method. Using these criteria weights, the experiments are ranked by using Reference Ideal Method. In the second part of the study, methods used in the study are explained briefly. In the third section, case study taken from literature is summarized. In the final sections, results and discussion, conclusion sections are given, respectively.

Materials and Methods

The case study is taken from Yan and Li's study (Yan and Li, 2013). The experiments are carried out by using CNC micromachining center. Face milling operation is performed. 3 flutes carbide tool is used in dry cutting operations. The dimension of the workpiece is 50×30×1.2 mm. The measurements are carried out by changing four parameters: spindle speed, feed rate, depth of cut and width of cut. Three levels are used for experimental design. The design of the experiments is given in Table 1. The purpose of the study is to maximize material removal rate (MRR) and to minimize surface roughness (SR) and cutting energy (CE).

Table 1. The design matrix of case study

Experiment no	Spindle speed (r/min)	Feed rate (mm/min)	Depth of cut(mm)	Width of cut (mm)	MRR (mm^3/min)	SR (µm)	CE (kj)
1	1000	200	0.2	5.00	200	2.15	555.802
2	1000	200	0.3	10.00	600	2.2	204.929
3	1000	200	0.4	15.00	1200	1.54	108.519
4	1000	250	0.2	5.00	250	3.28	446.109
5	1000	250	0.3	10.00	750	4.71	166.05
6	1000	250	0.4	15.00	1500	3.13	89.823
7	1000	300	0.2	5.00	300	4.43	381.832
8	1000	300	0.3	10.00	900	4.31	142.976
9	1000	300	0.4	15.00	1800	2.83	73.988
10	1500	200	0.2	5.00	400	3.05	357.042
11	1500	200	0.3	10.00	900	0.94	162.727
12	1500	200	0.4	15.00	400	3.48	319.031
13	1500	250	0.2	5.00	500	3.44	289.604
14	1500	250	0.3	10.00	1125	1.88	133.648
15	1500	250	0.4	15.00	500	3.73	258.476
16	1500	300	0.2	5.00	600	2.73	233.559
17	1500	300	0.3	10.00	1350	2.1	112.551
18	1500	300	0.4	15.00	600	1.99	213.109
19	2000	200	0.2	5.00	600	3.18	264.303
20	2000	200	0.3	10.00	300	3.89	445.797
21	2000	200	0.4	15.00	800	2.65	185.62
22	2000	250	0.2	5.00	750	2.58	213.939
23	2000	250	0.3	10.00	375	2.92	358.579
24	2000	250	0.4	15.00	1000	2.92	151.343
25	2000	300	0.2	5.00	900	2.39	180.886
26	2000	300	0.3	10.00	750	2.09	306.85
27	2000	300	0.4	15.00	1200	1.84	128.147

Results and Discussion

The purpose of the study is to maximize material removal rate (MRR) and to minimize surface roughness (SR) and cutting energy (CE). First, Best-Worst method is used to obtain these outputs' weights. According to five experts, criteria points are presented in Table 2. The average value of five experts' points are taken. Consistency ratio is lower than 0.1, so the analysis is consistent.

Table 2. Criteria points according to 5 experts.

EXPERT-1	SR	CE	MRR	Objective function value
Best:MRR	4	2	1	2.2e-7
Worst:SR	1	2	4	
EXPERT-2	SR	CE	MRR	
Best:MRR	3	3	1	7.5e-7
Worst:SR	1	1	3	
EXPERT-3	SR	CE	MRR	
Best:MRR	3	1	1	1.204e-7
Worst:SR	1	3	3	
EXPERT-4	SR	CE	MRR	
Best:MRR	4	4	1	2e-7
Worst:SR	1	1	4	
EXPERT-5	SR	CE	MRR	
Best:MRR	4	1	1	2.79e-7
Worst:SR	1	4	4	

By using experimental results, entropy weights are calculated. All the weights used in the model is given in Table 3.Three different weights are used in the analysis.

Table 3. Criteria weights used in the analysis

Methods	**MRR**	**SR**	**CE**
Case study (Yan and Li, 2013).	0.3315	0.2329	0.4356
Entropy	0.4400	0.1700	0.3900
Best Worst	0.5400	0.1500	0.3100

Range and reference ideal matrices are determined as follows.
Range matrix: AB = [100, 2000, 0.5, 6, 50, 600]
Reference ideal matrix: CD = [1800, 1800, 0.94, 0.94, 74, 74]
By using criteria weights from Table 3, RIM is developed. In Table 4, RIM results are presented.

Table 4. RIM results according to different weighting methods.

Weighting methods	**Rankings**
Case study (Yan and Li, 2013)	27-13-4-25-15-3-24-11-1-22-7-21-20-6-19-16-2-14-18-26-10-12-23-8-9-17-5
Best worst	27-14-4-25-12-2-24-10-1-22-8-21-20-6-19-16-3-15-18-26-11-13-23-7-9-17-5-16-4
Entropy	27-15-4-25-13-2-24-10-1-22-8-21-20-6-19-17-3-16-18-26-11-12-23-7-9-14-5

In Table 5, correlation coefficients of these rankings are given. The correlation coefficients are significant at 5% level which means there is no significant difference between rankings.

Table 5. Correlation matrix (r/p)

Methods	**Case study**	**Best-Worst**	**Entropy**
Case study	1.000/0.000	0.995/0.000	0.991/0.000
Best-Worst	0.995/0.000	1.000/0.000	0.996/0.000
Entropy	0.991/0.000	0.996/0.000	1.000/0.000

In Table 6, comparison of the results with literature is given. Experiment #9 is the optimum experiment, so the optimum cutting conditions are the same.

Table 6. Comparison of the results (Yan and Li, 2013).

Studies	Spindle speed	Feed rate	Depth of cut	Width of cut
Literature study	1000	300	0.4	15
Current study	1000	300	0.4	15

Conclusion

In this study, a new hybrid decision-making model is proposed. Best-Worst and entropy methods are used to calculate criteria weights and reference ideal method is used to determine the final rankings Face milling optimization problem was taken from the literature as a case study. The developed model was tested with this problem. The obtained results showed that calculated rankings are nearly same. There is no difference between these rankings at 5% significance level. The developed model can be used different optimization problems.

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A STUDY ON CORROSION BEHAVIOUR OF DIFFERENT AL MATRIX COMPOSITES

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Abstract: Different Al matrix metal compozites' s corrosion behavior is studied as literature rewiev. Al 6061 and Al 7075 matrix with SiC reinforcement are examined by using literature. SiC reinforcement action of compozite corrosion is identified by experiments. Optimum reinforcement volume rate is detected. Also, different method is examined for corrosion behavior. Besides, Al 2024 matrix metal compozites' s corrosion experiments which different method used, are submitted.
Keywords: composite, corrosıon, Al matrix,

Introduction

Aliminum is one of the materşal which is used after steel. Al is found in natüre easily. It has a density of 2,71 g/cm 3 nd the value is one third of steel's density.

Draft limit value of some Al alloys are higher than lot's of steel alloys. For this properties Al alloys are prefable for lightness desired applications.

Al based metal matrıx composıtes are important class of materıal, with non metallic reinforcements incorporated in metal matrices. Al alloy matrices, mainly 2024, 6061 and 7075 have been widely used as matrix materils with silicon carbide as their maor reinforcing agent. These materials have received incrased attention due to their potentially high fracture toughness and hıgh strength to weıght ratio.

The high thermal conductivity and low coefficient of thermal expansion of these materials have lead to a number of applications especially in automobile engine.

In corrosıve medıum, Al surface is coated with oxide layer to give a corrosion resistance to Al. With this property al is frequently used alloys. Al alloys consist of some elements such as Si, Zn, Mn and these are suitable for obtain galvanic ells. So that, ın terms of corrosion experiment Al is must be used for unique material. On the other hand, mechanical strength of Al is weakand single use of Al is not common (Chen 2016).

Mechanical and chemical properties of Al is change with micro structure and alloy elements. Most important alloy elements of Al are copper, Si, Magnezium and Zinc.

Medium strength and curable AlSiC alloys are well-formed and common used. Also, corrosion resistance of these alloys are high. SiC is the most common reinforcement element in metal matrix composites. The advantage of SiC is high thermal resistance.

Al7075 is top alloys of reinforcement metals and excellent power, low density, corrosion resistance, high thermal stability, are some important roperties. Unlike, using of metal cage composites, Al7075 is to increase corrosion rate, it is a disadvantage.

Al6061 has a high hardness strength, high corrosion resistance and well weldable. The corrosion resistance of Al6061-SiC is lower than püre Al alloy. On the other hand tensile strength of alloys is quite high.

Finally, Al2024 alloys, heat treatment processes are workable and fatigue strength is high. With surface coating, corrosion resistance is increasing. Because of its high strength and low density ; Al2024 is extensively used as structural materials in the aircraft and aerospace industries.

In thıs study, SiC reinforcement Al alloys studied for effecting corrosion resistance and literatur rewiev is done. Al7075, Al6061 and Al2024 alloys are studied seperately and results are compared.

Materials and Methods

Al7075, Al6061 and Al2024 corrosion experiments are done different methods. All of alloys SiC used as a reinforcement element with %15 weight ratio. Firstly, before corrosion experiments Al alloys are obtained from different metods also. Then the corrosion experiments are started. In (Table 1.) chemical compositions of Al7075, Al6061 and Al2024 and (Table 2.) properties of these alloys is given respectively .

Table 1. Chemical composition of Al2024 Al6061 and Al7075.

Element	Cr	Cu	Fe	Mg	Mn	Si	Ti	Zn	Al
Al2024	0.10	5.3	0.5	0.4	0.3	0.50	0.15	0.15	Balance
Al6061	0.04-0.35	0.15-0.4	0.7	0.8-1.2	0.15	0.4-0.8	0.15	0.25	Balance
Al7075	0.2	1.55	0.4	2.82	0.11	0.27	0.15	0.3	Balance

Table 2. Physical and chemical properties of Al2024, Al6061 and Al7075.

		Al2024	**Al6061**	**SiC**
Physical properties	Density (g/cm^3)	2.83	2.7	2.64
Chemical properties	Thermal Conductivity (W/mK)	196	167	200

Sun and friends studied that Al 7075 is an alloy which is well known for its structural properties and which is used in the production of metals which are also affordable and light weight. 0.1 M solution of acid chloride and 3.5% of natural chlorite were used in corrosion tests of Al7075 alloy. SiC with grain size of 60-90 micron was used as reinforcement element. Alloy was obtained by adding 2% and 4% by volume of SiC to the molten Al metal in the composite formation. In the corrosion tests of the obtained Al7075 alloy, weight loss was used as a method (Manjunatha 2016).

In corrosion experiments for Al7075, composite samples were washed, dried with acetone and weighted electronic scale. The samples were then dipped and weighed for 24 hours. Corrosion studies were carried out in hydrochloric acıd, acid sulphate, acid nitrat and NaCl solutions. The weight loss of the samples was measured for 24 hours during 1 week. The beakers mouths were kept closed during the test to avoid weight loss. After a certain period of time, the specimens are removed from the solution and washed to remove the corrosion residues, washed with acetone water and dried. Then, weighed graphs were made by measuring the weights of the weighed samples (Manjunatha 2016).

Al6061-SiC metal matrix composite is prepared by mixing casting technique. In thıs method, %99 of pure SiC is used while corrosion experiment is done, % 15 volume of SiC is used and alloy is obtained as a rod form. Cylindrical test coupons were cut from the rods and sealed with epoxy resin in such a way that, the areas of the composite. It is then degreased with acetone, washed with distilled water two times and dried before immersing in the corrosion medium. Experiments are carried out using a thermostat at temperatures 30 C, 35 C, 40 C, in sodium hydroxide solutions of concentrations 0.05 M, 0.1 M and 0.25 M (Kumari 2016)

Finally, Al2024 corrosion experiment, corrosion specimens are soaked in prepared acid NaCl solution with silicone protection on both grip ends. The corrosion solution was %9,5 sodium chloride solution and pH value is adjusted to about 4 by adding dropwise of dilute sulfuric acid. After corrosion, specimens are washed with distilled water for 2 min and blown dry with air. Corrosion method is multiaxial fatigue tests for Al2024.

All of these corrosion experiment the results are commented and supported with SEM photos (Sun 2009).

Results and Discussion

For this paper Al7075, Al601 and Al2024 alloys's corrosion experiments are studied. Three different corrosion method is used. These are weight loss, multiaxial fatigue and corrosion in NaOH solution.

For all method results it is clear that corrosion is effected negatively physical properties of Aliminum alloys. Also, corrosion time is important for matrices and surface corrosion is obtained for three alloys with increasing corrosion time. This surface corrosion is about reinforcement elements, temperatures sometimes.

It ıs seen that Aliminum alloys (Al7075, Al061 and Al2024), which are consist of Mg element is slowly increase corrosion resistance and while adding other elements especially SiC, the mechanical properties are very well for three different corrosion methods.

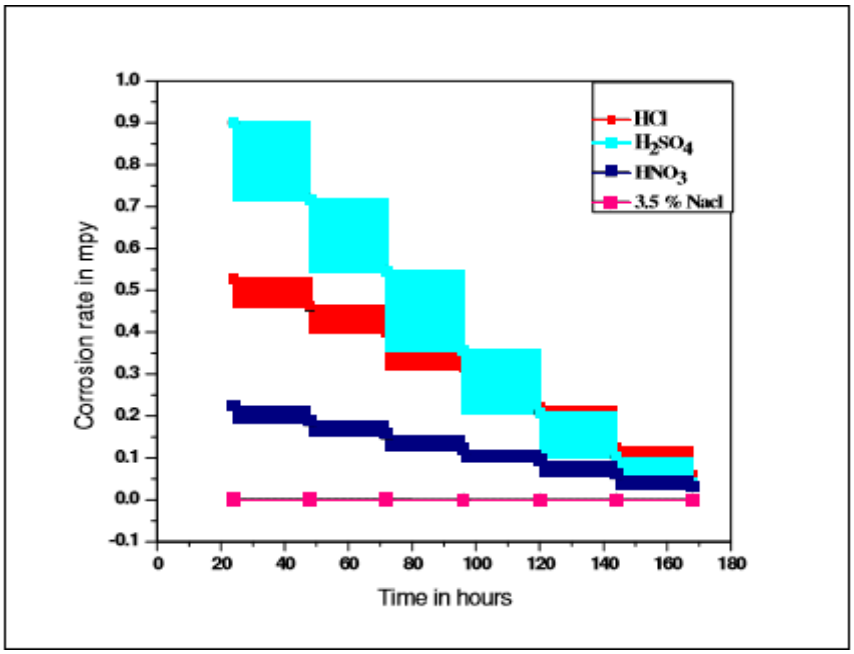

Figure 1. Weight loss corrosion test of Al 7075 alloy in different mediums.

As seen in Figure 1. Manjunatha and friends work's weight loss corrosion test results of Al7075, in NaCl, Sulfuric acid, Acid Nitrare and hydrochloric acid solutions. In NaCl solution, there is no corrosion rate. The maximum corrosion rate is obtained from sulfuric acid solution. In hydrochloric acid and acid nitrate solutions is also obtained high corrosion rate for Al7075 alloy.

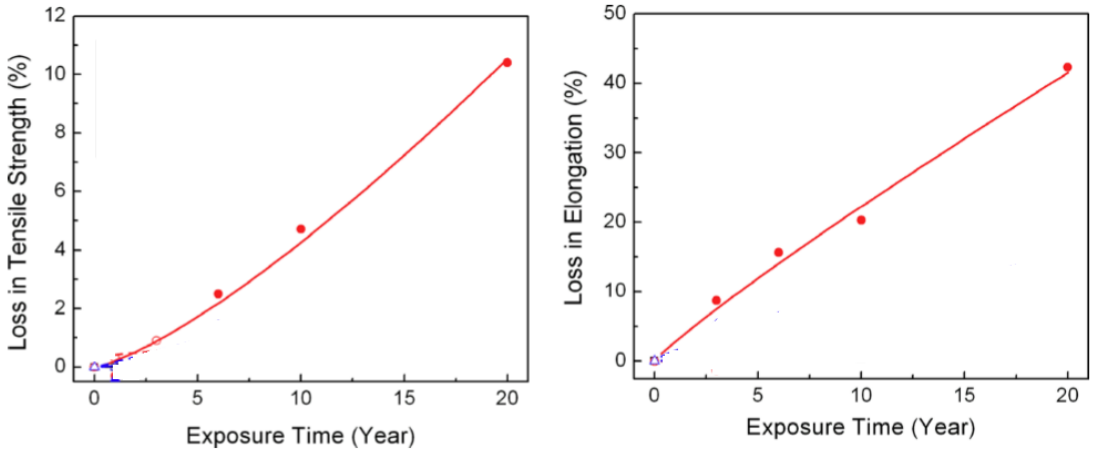

Figure 2. Losses in tensile strength and elongation for 7075 versus exposure time at wight loss method.

Tensile strength is important property for matrices and it is decreased with increaing corrosion rate and also corrosion rate is effected elongation. When the weight loss method is used in Al7075 alloy corrosion rate is effeccted mechanical properties. This method is effected negatively more than the others.

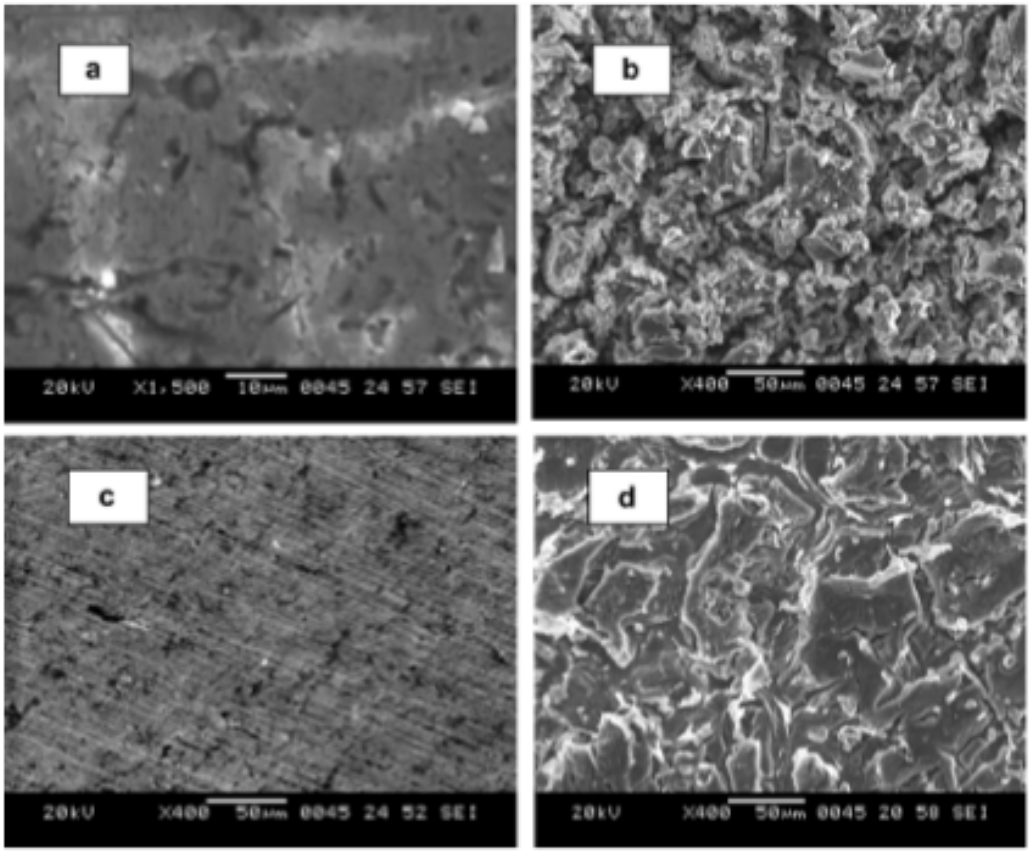

Figure 3. SEM image of Al6061 freshly polished surface of the composite (b) after immersion in 0.5 M NaOH. (c) Freshly polished surface of the base alloy (d) after immersion in 0.5 M NaOH.

As seen in (Figure 3.) SEM photos of composite surface and alloys photos which are in 0.5 M NaOH solutıon. It ıs clear that NaOH is formed high corrosıve medıum for Aluminum. Composıte samples are corrosive uniformly. The corrosion rate of Al-6061 increase with the increase in the concentration of sodium hydroxide. Also, it is observed the corrosion rate of Al6061 increase with the increase of temperature.

With multiaxial-fatigue corrosion method mechanical properties of Al2024 is also studied. Tensile strength, fatigue strength, tear strength and elongatıon values are seen in Figure 4. It ıs clear that increasing corrosion time of specimens loss in physcial properties are increasd also.

2024 under pre-corroded condition, multiaxial fatigue life decreases gradually with the increase of corroson time. With increasing corrosion time, stress concentration of specimens are increase.

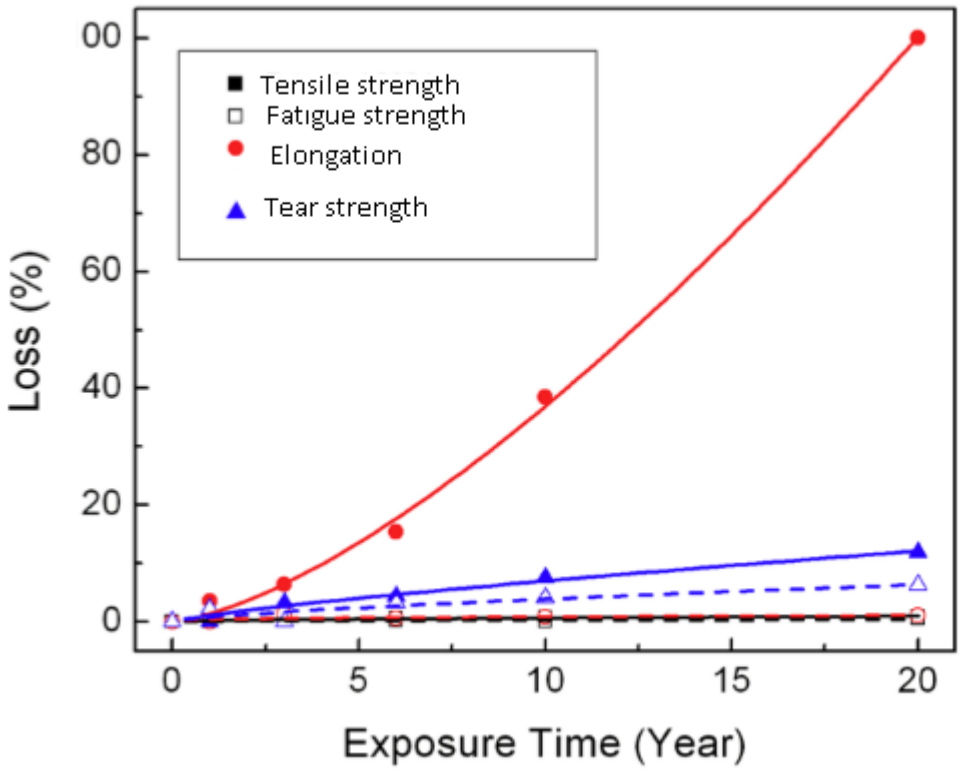

Figure 4. loss ın mechanical properties of Al2024 alloy.

It has been reported that the corrosion resistance of Al matrix composites depends on many factors such as proceessing technique; type and charasteristic of the matrix alloy; type, size, shape and amount of the reinforcement; the type of corrosive media, and the environmental factors. The fabricaion and processing of matrix composites sometimes lead to the formation of an interphase between the matrix and the reinforcements, which can also influence corrosion (Bedir 2015).

Some investigators have concluded that the increased corrosion rate is due to the formation of Al alloys at the reinforcement interface. It has been reported that the einforcing phase, in this work SiC is used reinforcement element, can also affected the corrosion behaviour of matrices by modifying the distribution of intermetallic phases in Al alloys (Zakaria 2014).

Acknowledgement

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AN ERROR ANALYSIS OF SEQUENCE-TO-SEQUENCE NEURAL NETWORKS ON ENGLISH PHONETIC ALPHABET CONVERSION

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Abstract: English words present inconsistency between their spelling and pronunciation, which requires phonetic alphabet for accurate pronunciation. However, each English dictionary not only lists a different set of pronunciation from one another, but also adopts a phonetic alphabet represented with different notation. These differences in pronunciation and phonetic notation confuse English language learners. A recent research on automatic conversion of different pronunciations shows a result with the accuracy between 74.5 ~ 89.6% produced utilizing sequence-to-sequence (seq2seq) model, a popular mechanism used in deep-learning.
This research suggests an error analysis conducted on the results of automatic conversion of different pronunciations. The errors are bidimensional. One dimension is classified into types of segment and suprasegment: consonant, vowel, stress errors. The other describes the types of errors including addition, deletion and alternation. The purposes of the error analysis can be summarized as follows: 1) to survey different phonetic alphabet systems for English and figure out the characteristics of each system, 2) to verify various pronunciation rules and the context information identified in automatically converted data, and finally 3) to suggest a guideline for organizing a training set to be used for learning the seq2seq model in automatic pronunciation conversion.

Keywords: English pronunciation, phonetic alphabet, sequence-to-sequence (seq2seq) model, error analysis

Introduction

The English spelling system does not represent the pronunciations of words: a written word does not necessarily express its vocal sound (Jurafsky, 2000). A phoneme can be expressed with many different letters of the alphabet, which causes difficulties in predicting an accurate pronunciation. Moreover, some letters are not pronounced at all, and mapping a phoneme to a letter can be represented utilizing one-to-many or many-to-one relationship. In other words, each phoneme is represented by more than one written letter or a sequence of letters, and a letter can be mapped to more than one sound. These types of inconsistency between the sound of a word and its spelling make learning English pronunciation difficult. Providing a phonetic alphabet system in a dictionary may help the learners of English to master the pronunciation. Many English dictionaries, however, present a system of their own, in which different phonetic alphabets are used to represent the same sound. Another inconsistency in phonetic alphabets also confuses the learners and becomes a cause to produce pronunciation errors.

This research aims to analyze the errors produced while automatically converting the phonetic alphabets to the notations adopted in other dictionaries (Lee and Choi, 2017). Those dictionaries include four different online English dictionaries: CMU Pronouncing Dictionary (CMUdict), New Oxford American Dictionary (NOAD), Merriam-Webster Collegiate Dictionary (MWCD), and New Oxford Dictionary of English (NODE)[1]. All the dictionaries provide phonetic alphabets to represent the pronunciations of each entry, but the notations are all varied from one another. Each of the four sets of phonetic alphabets is automatically converted to the rest three notations. The conversion was performed using a sequence2sequence model which outperforms other models when the length of the input sequence is not identical to that of the output. The average accuracy of the conversion

[1] CMUdict: http://www.speech.cs.cmu.edu/cgi-bin/cmudict
NOAD: https://en.oxforddictionaries.com/definition/us/
MWCD : https://www.merriam-webster.com/
NODE: https://en.oxforddictionaries.com/

is 83.1% and some of the conversion between particular sets exceeds 89%. When the conversion process has completed, conversion errors were collected for an analysis by which various types of errors were identified. This paper, however, focuses on the consonant errors, more specifically those which identified the errors between American and British English in particular. These types of errors are found when the conversion was processed between NOAD and NODE.

Characteristics of Phonetic Alphabets and Dictionaries

This research has initially selected four different online dictionaries: CMUdict, NOAD, MWCD and NODE. CMUdict is developed as an online dictionary for speech processing and has a reputation for its pronunciation representations. MWCD and NODE are traditionally well-known since their paper versions have been widely used. NOAD is selected because it is the American English counterpart of NODE. The pronunciations of these lexicons are transcribed using four different phonetic alphabet systems. CMUdict uses ARPAbet and NODE has adopted International Phonetic Alphabet (IPA). NOAD and MWCD have utilized the systems of their own named as NOAD and MWCD respectively.

CMUdict is originally created for use in speech recognition and lists the most number of entries, 117,413 which includes inflected forms. It transcribes North American pronunciations with utilizing 39 phonemes composed of 23 consonants and 16 vowels. NOAD is constructed based on NODE, but its 24,727 entries present the pronunciations of contemporary American English, represented with 42 phonemes among which there are 24 consonants and 19 vowels. MWCD contains 24,988 entries with American English pronunciations which are transcribed with 45 phonemes, 25 consonants and 20 vowels. NODE includes 24,458 entries whose pronunciations mainly represent British English. The pronunciations are transcribed with the most number of phonemes, 49 which are comprised of 26 consonants and 23 vowels. In addition, all the dictionaries present pronunciation variations for an entry if there is any. The average number of variations ranges from 1.069 to 1.313. However, the variations are often specified with partial transcriptions, providing only the different part of the full transcription. A dictionary entry is listed with its full pronunciation and optionally with the varied phoneme or the syllable(s) which includes the variations.

Automatic Conversion of Phonetic Alphabet for English Using Seq2seq Model

Deep Neural Networks (DNNs) have recently accomplished the state-of-the-art performance on various pattern-recognition tasks including speech and vision. They are remarkably powerful and flexible in resolving complicated problems for not only vision, but also language/speech processing such as machine translation in particular. Among language/speech processing applications adopting DNNs, Recurrent Neural Networks (RNNs) are a popular class since they can process arbitrary sequences of inputs. However, they show a limitation that they work with vectors of fixed dimensionality. In other words, they can achieve the expected performance only when the lengths of source and target are identical while some of language/speech related problems are represented with the sequences whose length is subject to change. Because of the limitation of RNNs, this research adopted a seq2seq model which consists of two RNNs utilizing sequential information.

Seq2seq Model

In the seq2seq model, one RNN computes a sequence of input as an encoder and the other generates the output as a decoder. The encoder RNN maps the various lengths of the input to a fixed-sized vector, and then the decoder RNN generates various lengths of output sequences from the vector (Cho et al., 2014).

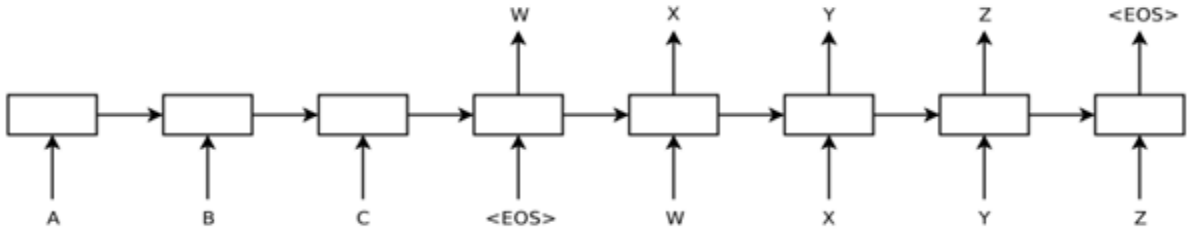

Figure 1. Basic Architecture of a seq2seq model (Sutskever et al., 2014)

The basic architecture depicted in Figure 1 represents the cells of the RNN, by which a sequence is processed. An encoder computes the input, ‘ABC’, creates a fixed-sized vector from which a decoder produces the output

sequence 'WXYZ' stopping when it reaches the end-of-sentence, <EOS>. Each sentence always ends with a special symbol, usually specified with 'EOS' by which all the possible lengths of sequences can be defined in the model. In a language/speech processing system utilizing the model, the probability of 'WXYZ<EOS>' is computed according to the representation of 'ABC' which is also computed by the first RNN.

This research has implemented a seq2seq model on automatic conversion of phonetic alphabets for English. The model is complemented to process different lengths of input and output sequences. As described with Figure 1 above, the model has successfully generated an output sequence whose length is different from that of the input.

Normalization of Dictionary Entries

The pronunciation transcriptions of all the entries were extracted from the four dictionaries. Since those pronunciation transcriptions utilizing phonetic alphabets are varied for the same entries, all of the transcriptions are listed under each entry. If there exist pronunciation variations, they are also listed after they are restored to a full pronunciation sequence.

Table 1: Examples of Pronunciation of MWCD

Entry	Pronunciations before Conversion	Pronunciations after Conversion
acceleration	/ik-ˌse-lə-ˈrā-shən, (ˌ)ak-/	ik-ˌse-lə-ˈrā-shən ˌak-ˌse-lə-ˈrā-shən ak-ˌse-lə-ˈrā-shən
proselytization	/ˌprä-s(ə-)lə-tə-ˈzā-shən, ˌprä-sə-ˌlī-tə-/	ˌprä-slə-tə-ˈzā-shən ˌprä-sə-lə-tə-ˈzā-shən
conference	/ˈkän-f(ə-)rən(t)s, -fərn(t)s/	ˈkän-fə-rənts ˈkän-fə-rəns ˈkän-frənts ˈkän-frəns

The variations in all the dictionaries are presented as shown in the second column of Table 1 under "Pronunciation before Conversion". For example, two pronunciations are mapped to an entry '*conference*'; 1) /ˈkän-f(ə-)rən(t)s/ and 2) / -fərn(t)s/. The first transcription represents a full pronunciation although it includes two options by which a weak vowel known as schwa can be reduced and the voiceless alveolar stop, /t/ can also be omitted. The third column under "Pronunciations after Conversion" displays all the variations restored as full pronunciations which are generated calculating the possible combinations with the given options. Restoring the variations to the corresponding full pronunciation is performed as preprocessing. However, some of the restored sequences are eliminated from the final output list if there is a difference in the total number of syllable[2].

When all the variations are extended to a full pronunciation, an appropriate stress pattern is added to complete the pronunciation. Lexical stress is relative emphasis to a certain syllable, which is caused by phonetic properties such as loudness or vowel length. English has one or more syllables in every word and stress is placed on one or more syllables. Lexical stress in English presents different levels including primary, secondary and tertiary although the position of each level is less predictable. Accordingly, English stress patterns have to be memorized as part of the pronunciation. More importantly, lexical stress in English is contrastive to distinguish parts of speech. Given a pair of identical strings, they convey two different meanings from each other if stress is placed on different syllables. Some words may contain more than one stressed vowel, but exactly one of the stressed vowels is more prominent than the others. Each dictionary presents a unique system to indicate the stress pattern of a word and shows the different number of stress for the same word. Moreover, British and American English have different stress patterns from each other, which also leads to reduction of a vowel. These differences result in dissimilar pronunciations.

[2] This process will be complemented in the next step of the research so that all the restored sequences can make the final output list.

Table 2: Stress Systems

Dictionary	*insignia*	*rare*	*rehab*
CMUdict	IH2 N S IH1 G N IY2 AH0	R EH1 R	R IY0 HH AE0 B
NOAD	inˈsignēə	rer	ˈrēˌhab
MWCD	in-ˈsig-nē-ə	ˈrer	ˈrē-ˌhab
NODE	ɪnˈsɪgnɪə	rɛː	ˈriːhab

Table 2 displays the differences in the stress pattern of the dictionaries. The stress is placed before the stressed syllable in NOAD/MWCD/NODE whereas it is indicated after the stressed vowel in CMUdict, using a number, 0~2. There is no special indication in IPA/MWCD/NOAD for no stress while '0' is inserted in CMUdict.

Table 3: Stress Description

Phonetic Alphabet	**Primary Stress**	**Secondary Stress**	**No Stress**
IPA / MWCD / NOAD	[']	[,]	
ARPAbet	1	2	0
Standardization	*	%	

Different stress systems are standardized in order to train automatic conversion of pronunciations among the dictionaries. Table 3 shows the standardized notation of stress patterns. The primary stress is represented with the asterisk symbol '*' while the secondary is indicated using the percent symbol, '%'. Both of them are inserted at the end of a stressed syllable.

When adding a stress pattern to all the entries is completed, non-ASCII codes are mapped to ASCII ones. NOAD, MWCD and NODE contain some of the non-ASCII code to represent phonemes. The mapping process is necessary in order to ease the conversion process. In addition, the dash symbol, '-' is inserted between the phonemes for clear distinction.

Table 4: Sample Input Words for Seq2seq Model

		insignia	*rare*	*rehab*
Original Entries	CMUdict	IH2 N S IH1 G N IY2 AH0	R EH1 R	R IY0 HH AE0 B
	NOAD	inˈsignēə	rer	ˈrēˌhab
	MWCD	in-ˈsig-nē-ə	ˈrer	ˈrē-ˌhab
	NODE	ɪnˈsɪgnɪə	rɛː	ˈriːhab
Normalized Entries	CMUdict	IH-%-N-S-IH-*-G-N-IY-%-AH	R-EH-*-R	R-IY-HH-AE-B
	NOAD	I1-N-S-I1-*-G-N-E2-E3	R-E1-R	R-E2-*-H-A1-%-B
	MWCD	I1-N-S-I1-*-G-N-E2-E3	R-E1-*-R	R-E2-*-H-A1-%-B
	NODE	I2-N-S-I2-*-G-N-I2-E3	R-E2:	R-I1:-*-H-A4-B

Table 4 lists normalized word examples to be used as input for training which utilizes a seq2seq model. The stress pattern is now represented with the standardized notation for the entries in all the dictionaries.

Automatic Conversion with Seq2seg Model and Experimental Results

To train the seq2seq model, 12 models have been constructed since the pronunciations of each dictionary have to be converted to those transcribed in the rest of the dictionaries. Each dictionary is coupled with the rest of the dictionaries, which results in 6 conversion pairs prepared for bidirectional conversion.

Table 5: Size of Training Data

Conversion Pairs	Number of Entries in Training Data
MWCD(MWCD) ↔ NODE(IPA)	44,086
MWCD(MWCD) ↔ CMUdict(ARPAbet)	37,471
MWCD(MWCD) ↔ NOAD(NOAD)	45,549
CMUdict(ARPAbet) ↔ NODE(IPA)	34,664
CMUdict(ARPAbet) ↔ NOAD(NOAD)	35,082
NODE(IPA) ↔ NOAD(NOAD)	44,403

With the normalized entries completed, training data sets are created for all the six pairs. The size of the training data varies for each pair as presented in Table 5. Although each model requires a different setting of parameters for training, all the models have been trained using the optimized parameters set for the two models. When the training is completed, a test data set is created with 1,000 entries, all of which are commonly listed in the four dictionaries. With this testing data, the conversion performances are evaluated.

Table 6: Accuracy of Conversion Results

Conversion	Accuracy	Conversion	Accuracy
NOAD(NOAD) → MWCD(MWCD)	89.6	MWCD(MWCD) → CMUdict(ARPAbet)	82.0
CMUdict(ARPAbet) → MWCD(MWCD)	88.9	NOAD(NOAD) → CMUdict(ARPAbet)	81.5
MWCD(MWCD) → NOAD(NOAD)	87.8	MWCD(MWCD) → NODE(IPA)	81.3
CMUdict(ARPAbet) → NOAD(NOAD)	87.6	CMUdict(ARPAbet) → NODE(IPA)	79.7
NODE(IPA) → MWCD(MWCD)	83.8	NOAD(NOAD) → NODE(IPA)	77.9
NODE(IPA) → NOAD(NOAD)	82.1	NODE(IPA) → CMUdict(ARPAbet)	74.5

Table 6 presents the accuracy of automatic conversion performed on each pair of the models. The highest accuracy is 89.6% produced when NOAD(NOAD) is converted to MWCD(MWCD). The result seems natural since both dictionaries transcribe the pronunciation of American English. On the other hand, the conversion from NODE(IPA) to CMUdict(ARPAbet) shows the lowest performance resulting in the accuracy of 74.5%. The low performance seems attributed to the fact that NODE transcribes British English whereas CMUdict provides the pronunciation of American English. This can be confirmed by the other two results with low accuracy produced by the conversion from NOAD(NOAD) to NODE(IPA) and from CMUdict(ARPAbet) to NODE(IPA). All of the three models convert British English from/to American English.

Error Analysis of Automatic Conversion

This research focuses on the results produced while converting NOAD to NODE and vice versa. Since they transcribe the pronunciation of American and British English respectively, the results are considered as useful sources to detect the meaningful conversion errors. The conversion result is analyzed and classified according to the type of errors. Three prominent types include stress, vowel, and consonant. This research, however, focuses on consonant related errors. American and British English present differences in a set of consonants transcribing the same word.

Table 7: Pronunciation Variations of Consonants

British English	American English
(❒)	❒
♦	☼
●	☾
⌘	♦
♦	●
❄	❄

Table 7 lists up the pronunciation variations in some of the consonants between British and American English (Hosseinzadeh, et al., 2015). One of the most prominent differences is the rhotic /r/. In American English, the letter 'r' is mostly pronounced except the cases in some dialects. However, it is not pronounced in British English when it occurs in the coda position. For example, a word, *park* is pronounced as /park/ in American English while it is dropped in British English as in /pak/.

Table 8: Errors on Converting /r/ #1

		To **NOAD**	
		☼	**/r/**
From **NODE**	**No /r/** *in* **Testing Data**	Correct: 441 Incorrect: 20	Correct: 191 Incorrect: 23
	No /r/ *in* **Training Data**	None	7,165

The process of converting NODE to NOAD has produced 441 correct cases and 20 incorrect cases of not inserting /r/ as Table 8 has presented. The conversion is incorrect because the rhotic /r/ in British English has to be realized as /r/ in American English, but it failed as in /ˌaftəˈnōon/ which is meant to be /ˌaftərˈnōon/. Similarly, 23 errors have been detected when /r/ should not be inserted in NOAD since /r/ is neither rhotic nor included in the words listed in NODE.

Table 9: Errors on Converting /r/ #2

Entry	NODE (IPA)	NOAD (NOAD) reference	NOAD (NOAD) model	Description
yoga	ˈjəʊgə	ˈyōgə	ˈyōgər	/r/ insertion error
sigma	ˈsɪgmə	ˈsigmə	ˈsigmər	/r/ insertion error
forerunner	ˈfɔːrʌnə	ˈfôrˌrənər	ˈfôˌrənər	/r/ deletion error
joker	ˈdʒəʊkə	ˈjōkər	ˈjōkə	/r/ deletion error
altogether	ɔːltəˈgɛðə	ˌôltəˈgeT͟Hər	ˌôltəˈgeT͟Hər	correct (/r/ insertion)
benefactor	ˈbɛnɪfaktə	ˈbenəˌfaktər	ˈbenəˌfaktər	correct (/r/ insertion)

Table 9 displays more examples of the results produced by converting /r/. For example, a word, *yoga* should be converted to /ˈyōgə/ rather than /ˈyōgər/ in which the inserted /r/ causes an error. In the training set, there are 7,165 cases in which British rhotic /r/ is correctly restored in NOAD. Table 8 also presents the correctly converted examples such as *altogether*: the last phoneme /r/ in NOAD has been successfully restored.

Another prominent pronunciation variation is mapping /t/ in British English and /d/[3] in American English. The voiceless alveolar stop, /t/ in British English often pronounced as a voiced alveolar flap in American English usually when it occurs in an intervocalic position or the phoneme is represented by a double 't' in its spelling.

[3] This is supposed to be the voiced alveolar flap /☼/, but NOAD uses /d/ to represent it.

Table 10: Errors on Converting /t/ #1

		To **NOAD**	
		/t/	**/d/**
From **NODE**	**/t/** *in* **Testing Data**	Correct: 213 Incorrect: 2	Correct: 55 Incorrect: 4
	/t/ *in* **Training Data**	12,292	3,246

As the result is shown in Table 10, the conversion of /t/ has generated only a couple of errors; British /t/ is supposed to be realized as /d/, but /t/ is produced instead. Another small number of errors are produced when /t/ is converted to /d/ rather than /t/ which is the intended result.

Table 11: Errors on Converting /t/ #2

Entry	**NODE (IPA)**	**NOAD (NOAD) reference**	**NOAD (NOAD) model**	**Description**
prophetess	ˌprɒfɪˈtɛs	ˈpräfədəs	ˈpräfətəs	/d/→/t/ error
ghettoize	ˈgɛtəʊʌɪz	ˈgedōˌīz	ˈgetōˌīz	/d/→/t/ error
aglitter	əˈglɪtə	əˈglɪtə	əˈglɪdə	/t/→/d/ error
footlights	ˈfʊtlʌɪts	ˈfo͡otˌlīts	ˈfo͡odˌlīts	/t/→/d/ error
bottom	ˈbɒtəm	ˈbädəm	ˈbädəm	correct (/t/→/d/)
waiter	ˈweɪtə	ˈwādər	ˈwādər	correct (/t/→/d/)

Table 11 presents a set of examples in which both correct and incorrect conversion examples are listed. The voiceless alveolar stop is trained to be converted to the flap, but it stays in the pronunciation of a word such as *prophetess* of NOAD causing an error. On the other hand, /t/ is converted to /d/ in *footlights* when it should not.

Table 12: Errors on Converting /t/ #3

		To **NOAD**	
		/t/	
From **NODE**	**/t/** *in* **Testing Data**	Correct: 213 Incorrect: None	Correct: None Incorrect: 1
	/t/ *in* **Training Data**	12,292	717

Table 12 shows an interesting result of converting /t/. NODE /t/ has been successfully converted to /t/ in NOAD, without generating an error. When the British /t/ is converted to null in NOAD, only a single error has produced. However, no correct conversion has occurred either.

Table 13: Errors on Converting /t/ #4

Entry	NODE (IPA)	NOAD (NOAD) reference	NOAD (NOAD) model	Description
antler	ˈantlə	ˈantlər	ˈanlər	/t/ deletion error
costly	ˈkɒstli	ˈkôslē	ˈkôslē	correct (/t/ deletion)
frantic	ˈfrantɪk	ˈfranik	ˈfranik	correct (/t/ deletion)
hunter	ˈhʌntə	ˈhənər	ˈhənər	correct (/t/ deletion)

More examples are provided in Table 13. It lists the single error on converting /t/ to null as in *antler* in which /t/ is supposed to remain as is. In many other cases, the voiceless alveolar stop in British English becomes silent in some American English words as in *hunter*, which is not an error. This type of examples is included in the training data, but no such case has been found in the testing data.

Table 14: Errors on Converting /☠/ #1

		To **NOAD**	
		/NG/	**/n/**
From **NODE**	**/☠/** *in* **Testing Data**	Correct: 11 Incorrect: 1	Correct: None Incorrect: 1
	/☠/ *in* **Training Data**	2,028	49

The next case is converting the velar nasal stop /☠/ in British English to the alveolar nasal /n/ in American English. As Table 14 suggests, this is a rather rare case. Although the training data set contains 2,028 correct conversions of /☠/ to /NG/, only 11 correct conversions are identified. Converting /☠/ to /n/ has been trained with 49 conversion cases, but no such cases have been found in the testing process.

Table 15: Errors on Converting /☠/ #2

Entry	NODE (IPA)	NOAD (NOAD) reference	NOAD (NOAD) model	Description
conclave	ˈkɒŋkleɪv	ˈkän¸klāv	ˈkä NG¸klāv	/n/→/NG/ error
congresswoman	ˈkɒŋgrɛs¸wʊmən	ˈkäNGgrəs¸woomən	ˈkängrəs¸woomən	/NG/→/n/ error
exceedingly	ɪkˈsiːdɪŋl	ikˈsēdiNGlē	ikˈsēdiNGlē	correct (/ŋ/→/NG/)
spanking	ˈspaŋkɪŋ	ˈspaNGkiNG	ˈspaNGkiNG	correct (/ŋ/→/NG/)
concrete	ˈkɒŋkriːt	ˈkän¸krēt	ˈkän¸krēt	correct (/ŋ/→/n/)
increase	ˈɪŋkriːs	inˈkrēs	inˈkrēs	correct (/ŋ/→/n/)

Table 15 includes a pair of errors where /☠/ is incorrectly realized as /NG/ instead of /n/ as in *conclave*, and as /n/ when it is intended for /NG/ as in *congresswoman*. It also lists several examples of correctly converted /☠/ to /NG/ such as *exceedingly* and to /n/ as in *increase*.

Table 16: Errors on Converting /p/ #1

		To **NOAD**	
		/p/	**␣**
From **NODE**	**No /p/** *in* **Testing Data**	Correct: None Incorrect: 1	Correct: None Incorrect: None
	No /p/ *in* **Training Data**	64	None

In American English, the voiceless bilabial stop /p/ is mostly pronounced when it appears in its spelling as in *assumption*. However, it is silent in British English. The training data set lists 64 cases of correct conversion in

which the silent /p/ of NODE has been restored to /p/. However, the testing set does not include a single case of the conversion as shown in Table 16.

Table 17. Error on Converting /p/ #2

Entry	NODE (IPA)	NOAD (NOAD) reference	NOAD (NOAD) model	Description
sometime	ˈsʌmtʌɪm	ˈsəmˌtīm	ˈsəmˌptīm	/p/ insertion error

Table 17 presents an example of incorrectly converted /p/ as in an entry, *sometime*. The voiceless bilabial stop is inserted in NOAD when it should not.

Table 18. Examples of Converting /p/ in Training Data

Entry	NODE (IPA)		NOAD (NOAD)	
assumption	əˈsʌmʃn	əˈsʌmʃən	əˈsəmSHn	əˈsəmSHən
	əˈsʌmpʃn	əˈsʌmpʃən	əˈsəmpSHn	əˈsəmpSHən
humpback	ˈhʌmbak	ˈhʌmpbak	ˈhəmpˌbak	
symptom	ˈsɪmtəm	ˈsɪmptəm	ˈsimtəm	ˈsimptəm

Table 18 lists up the cases of correct conversion of /p/ included in the training data. With examining the training data, the cause for the error in *sometime* is detected as shown in Table 17. For example, when an entry has pronunciation variations as in *assumption*, it generated 16 possible cases for the training. Some of the data such as /əˈsʌmʃn/ and əˈsəmpSHən/ has causes the error in *sometime*; even when there is no /p/ in the source data, /p/ is inserted in the target data. In other words, the accuracy of the seq2seq model decreases when there are more than one training data for an input sequence.

Conclusion

This research has presented automatic conversions of phonetic alphabets for English utilizing a seq2seq model. Examining the conversion results helps verifying the differences in pronunciations between British and American English. One of the most noticeable distinctions is pronouncing /r/ and /t/ which represent the typical pronunciations of the two dialects of English.

A seq2seq model was implemented for this research since it is known for its good performance in successfully generating an output sequence whose length is different from that of the input. However, some of the errors suggest that the quality of the training data determines the accuracy of the performance. The model has performed well on the input which a single output is mapped to, but it requires further adjustment on creating a training data set for the cases in which multiple outputs are expected. In other words, high performance can be guaranteed only when accurate training data is prepared or a very large volume of data is provided. In the following step of the research, the data presented in Table 7 will be analyzed and discussed. In addition, the errors on vowel will be identified for further analysis and discussion.

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ASYMPTOTICALLY $\alpha_f^p(I)$-LACUNARY EQUIVALENT SEQUENCES SPACES

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Abstract: In this study, we define $\alpha_f^p(I)$- lacunary equivalence with order α, and asymptotically $\alpha_f(I)$-lacunary statistical equivalence with order α,which is a natural combination of the defintion for asymptotically equivalent, Ideal convergence, Statistically limit, Lacunary sequence, Modulus function and a sequence of positive real numbers $p=(p_k)$ and give some relations about these concepts.

Keywords: Asymptotically equivalence, Ideal convergence, Lacunary sequence, Modulus function, Statistically limit.

MSC (2010): 40A05,40A35,40A99,40G15

Introduction

Let s, ℓ_∞,c denote the spaces of all real sequences, bounded, and convergent sequences,respectively. Any subspace of s is called a sequence space. A lacunary sequence is an increasing sequence $\theta=(k_r)$ such that $k_0=0$, $h_r = k_r - k_{r-1} \to \infty$ as $r\to\infty$ .The intervals determined by θ will be denoted by $I_r=(k_{r-1},k_r]$ and $q_r = k_r/k_{r-1}$ .These notations will be used troughout the paper. The sequence space of lacunary strongly convergent sequences N_θ was defined by Freedman et al.(1978), as follows:

N_θ ={x=(x_i)∈s: $lim_r h_r \sum_{i\in I_r}|x_i - L|=0$ for some L}.

The notion of modulus function was introduced by Nakano (1953). We recall that a modulus f is a function from [0,∞) to [0,∞)such that (i) f(x) =0 if and only if x=0 ,(ii) f(x+y) ≤ f(x)+f(y) for x,y≥0, (iii) f is increasing and (iv) f is continuous from the right at 0. Hence f must be continuous everywhere on [0,∞). Bhardwaj & Dhawan (2015),Kolk (1993), Maddox (1986), Öztürk and Bilgin (1994), Pehlivan and Fisher (1994), Ruckle (1973), and others used a modulus function to construct sequence spaces. Marouf (1993), presented definitions for asymptotically equivalent sequences and asymptotic regular matrices. Patterson (2003), extended these concepts by presenting an asymptotically statistical equivalent analog of these definitions and natural regularity conditions for nonnegative summability matrices . Subsequently, many authors have shown their interest to solve different problems arising in this area (see (Basarir and Altundag,2008). (Basarir and Altundag,2011), (Bilgin,2011), and (Patterson and Savas,2006)). The concept of I-convergence was introduced by Kostyrko et al. (2000/2001) in a metric space. Later it was further studied by Bilgin (2015),,Dass et al. (2011), Dems (2004-2005), Kumar and Sharma (2012), Savaş and Gumus (2013), and many others. In this paper we introduce the concepts asymptotically $\alpha_f^p(I)$ -lacunary equivalence with order α, and asymptotically $\alpha_f(I)$ -lacunary statistical equivalence with order α,which is a natural combination of the defintion for asymptotically equivalent, Ideal convergence, Statistically limit, Lacunary sequence, Modulus function and a sequence of positive real numbers $p=(p_k)$ and also some inclusion theorems are proved.

Materials and Methods

Now we recall some definitions of sequence spaces

Definition 2.1. Two nonnegative sequences [x]and [y] are said to be asymptotically equivalent if : $lim_k \frac{x_k}{y_k}$=1,(denoted by x∽y).

Definition 2.2. Two nonnegative sequences [x] and [y] are said to be asymptotically statistical equivalent of multiple L provided that for every ε > 0, $lim_n \frac{1}{n}|\{ k\le n: |\frac{x_k}{y_k}-L|\ge\varepsilon\}|=0$,(denoted by $x \overset{S}{\approx} y$) and simply asymptotically statistical equivalent, if L=1.

Definition 2.3. Let θ be a lacunary sequence; the two nonnegative sequences [x] and [y] are said to be asymptotically lacunary statistical equivalent of multiple L provided that for every ε > 0,

$lim_r \frac{1}{h_r}|\{ k\in I_r:| \frac{x_k}{y_k}-L|\geq\varepsilon\}|=0$,(denoted by $x \overset{S_\theta}{\approx} y$) and simply asymptotically lacunary statistical equivalent, if L=1.

Definition 2.4. Let f be any modulus; the two nonnegative sequences [x] and [y]are said to be f-asymptotically equivalent of multiple L provided that,

$lim_k f(| \frac{x_k}{y_k}-L|)=0$ (denoted by $x \overset{f}{\approx} y$)and simply strong f-asymptotically equivalent, if L=1.

Definition 2.5. Let f be any modulus, $\theta=(k_r)$ be a lacunary sequence, $p=(p_k)$ be a sequence of positive real numbers and $0 < \alpha \leq 1$; the two nonnegative sequences [x] and [y] are said to be strong α_f^p-asymptotically lacunary equivalent of order α, to multiple L provided that

$\lim_r \frac{1}{h_r^\alpha} \sum_{k\in I_r} [f(|\frac{x_k}{y_k} - L|)]^{p_k}$,(denoted by $x \overset{N_\theta, \alpha_f^p}{\approx} y$) and simply strong α_f^p-asymptotically lacunary equivalent, if L=1.

Definition 2.6. Let f be any modulus, $\theta=(k_r)$ be a lacunary sequence, and $0 < \alpha \leq 1$; the two nonnegative sequences [x] and [y] are said to be asymptotically α_f-lacunary statistical equivalent of order α, to multiple L provided that for every $\varepsilon > 0$,

$lim_r \frac{1}{h_r^\alpha}|\{ k\in I_r:f(| \frac{x_k}{y_k}-L|)\geq\varepsilon\}|=0$,(denoted by $x \overset{S_\theta, \alpha_f}{\approx} y$) and simply asymptotically α_f-lacunary statistical equivalent, if L=1.

For any non-empty set X, let P(X) denote the power set of X.

Definition 2.7. A family $I\subseteq P(X)$is said to be an ideal in X if

(i) $\emptyset\in I$;
(ii) $A,B\in I$ imply $A\cup B\in I$ and
(iii) $A\in I, B\subset A$ imply $B\in I$.

Definition 2.8. A non-empty family $F\subseteq P(X)$is said to be a filter in X if

(i) $\emptyset\notin F$;
(ii) $A,B\in F$ imply $A\cap B\in F$ and
(iii) $A\in F, B\supset A$ imply $B\in F$.

An ideal I is said to be non-trivial if $I\neq\{\emptyset\}$and $X\notin I$.A non-trivial ideal I is called admissible if it contains all the singleton sets. Moreover, if I is a non-trivial ideal on X, then $F=F(I)=\{X-A:A\in I\}$ is a filter on X and conversely. The filterF(I) is called the filter associated with the ideal I.

Definition 2.9. Let $I\subset P(N)$ be a non-trivial ideal in N and (X,ρ) be a metric space. A sequence [x] in X is said to be I-convergent to ξ if for each $\varepsilon > 0$, the set $\{k\in N:\rho(x_k,\xi)\geq\varepsilon\}\in I$.

In this case, we write $I\text{-}lim_k x_k=\xi$.

Definition 2.10. A sequence [x] of numbers is said to be I-statistical convergent or S(I)-convergent to L, if for every $\varepsilon > 0$ and $\delta > 0$, we have $\{n\in N;(1/n)|\{k\leq n:| x_k - L|\geq\varepsilon\}|\geq\delta\}\in I$.

In this case, we write $x_k \to L$ (S(I)) or S(I) $-lim_k x_k=L$.

Definition 2.11. Let $I\subset P(N)$ be a non-trivial ideal in N and $\theta=(k_r)$ be a lacunary sequence. The two nonnegative sequences [x] and [y] are said to be asymptotically lacunary statistical equivalent of multiple L with respect to the ideal I provided that for each $\varepsilon > 0$ and $\gamma > 0$, $\{r\in N; \frac{1}{h_r}|\{ k\in I_r:| \frac{x_k}{y_k}-L|\geq\varepsilon\}|\geq\gamma\} \in I$, denoted by $x \overset{I(S_\theta)}{\approx} y$ and simply asymptotically lacunary statistical equivalent with respect to the ideal I, if L=1.

Definition 2.12. Let $I\subset P(N)$ be a non-trivial ideal in N and $\theta=(k_r)$ be a lacunary sequence. The two non-negative sequences [x] and [y] are said to be strongly asymptotically lacunary equivalent of multiple L with respect to the ideal I provided that for $\varepsilon > 0$ $\{r\in N; \frac{1}{h_r}\sum_{k\in I_r}|\frac{x_k}{y_k} - L|\geq\varepsilon\} \in I$, denoted by $x \overset{I(N_\theta)}{\approx} y$ and simply strongly asymptotically lacunary equivalent with respect to the ideal I, if L=1.

Definition 2.13. Let $I\subset P(N)$ be a non-trivial ideal in N and f be a modulus function. The two non-negative sequences [x] and [y] are said to be f - asymptotically equivalent of multiple L with respect to the ideal I provided that for each $\varepsilon > 0$ $\{k\in N; f(| \frac{x_k}{y_k}-L|)\geq\varepsilon\} \in I$

denoted by x $\underset{\approx}{I(f)}$ y and simply f-asymptotically equivalent with respect to the ideal I, if L=1.

Results and Discussion

We now consider our main results. We begin with the following definitions.

Definition 3.1. Let I⊂P(N) be a non-trivial ideal in N , f be a modulus function, and p = (p_k) be a sequence of positive real numbers and 0 < α ≤1;. Two number sequences [x] and [y] are said to be strongly (f,p)-asymptotically equivalent of multiple L with respect to the ideal I provided that for each ε > 0 ,

{n∈N; $\frac{1}{n^{\alpha}}\sum_{k=1}^{n}[f(|\frac{x_k}{y_k}-L|)]^{p_k} \geq \varepsilon\}$ ∈I denoted by x $\underset{\approx}{w,\alpha_f^p(I)}$ y and simply strongly $\alpha_f^p(I)$-asymptotically equivalent with respect to the ideal I, if L=1.

If we take α=1,we write x $\underset{\approx}{\alpha_f^p(I)}$ y instead of x $\underset{\approx}{w,\alpha_f^p(I)}$ y.

If we take f(x)=x for x≥0 , we write x $\underset{\approx}{w,\alpha^p(I)}$ y instead of x $\underset{\approx}{w,\alpha_f^p(I)}$ y.

If we take p_k=1 for all k∈N, we write x $\underset{\approx}{w,\alpha_f(I)}$ y instead of x $\underset{\approx}{w,\alpha_f^p(I)}$ y

Definition 3.2. Let I⊂P(N) be a non-trivial ideal in N , f be a modulus function , θ=(k_r) be a lacunary sequence, and p = p_k) be a sequence of positive real numbers and 0 < α ≤1. Two number sequences [x] and [y] are said to be strongly (f,p)-asymptotically lacunary equivalent of multiple L with respect to the ideal I provided that for each ε > 0,

{r∈N; $\frac{1}{h_r^{\alpha}}\sum_{k\in I_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k} \geq \varepsilon\}$ ∈I denoted by x $\underset{\approx}{N_\theta,\alpha_f^p(I)}$ y and simply strongly $\alpha_f^p(I)$-asymptotically lacunary equivalent with respect to the ideal I, if L=1.

If we take α=1 , we write x $\underset{\approx}{N_\theta,{}_f^p(I)}$ y instead of x $\underset{\approx}{N_\theta,\alpha_f^p(I)}$ y . Hence x $\underset{\approx}{N_\theta,{}_f^p(I)}$ y is the same as the x $\underset{\approx}{I(N_\theta^{(f,p)})}$ y of Bilgin (2011),

Note that,we take p_k=1 for all k∈N, we write x $\underset{\approx}{N_\theta,{}_f(I)}$ y instead of x $\underset{\approx}{N_\theta,\alpha_f^p(I)}$ y. Hence x $\underset{\approx}{N_\theta,{}_f(I)}$ y is the same as the x $\underset{\approx}{I(N_\theta^f)}$ y of Kumar and Sharma (2012). Also if we put f(x)=x for x≥0 , we write x $\underset{\approx}{N_\theta,{}^p(I)}$ y instead of x $\underset{\approx}{N_\theta,{}_f^p(I)}$ y. Hence x $\underset{\approx}{N_\theta,{}^p(I)}$ y is the same as the x $\underset{\approx}{N_\theta^{L(p)}(I)}$ y of Savaş and Gumus (2013).

Definition 3.3. Let I⊂P(N) be a non-trivial ideal in N , f be a modulus function , θ=(k_r) be a lacunary sequence, and p=(p_k) be a sequence of positive real numbers and 0<α≤1. the two nonnegative sequences [x] and [y] are said to be asymptotically α_f (I)- -lacunary statistical equivalent of order α, to multiple L with respect to the ideal I provided that for every ε>0,and γ>0,

{r∈N; $\frac{1}{h_r^{\alpha}}|\{k\in I_r: f(|\frac{x_k}{y_k}-L|)\geq\varepsilon\}|\geq\gamma\}$ ∈I (denoted by x $\underset{\approx}{S_\theta,\alpha_f(I)}$ y)

If we take α=1 , we write x $\underset{\approx}{S_\theta,{}_f(I)}$ y instead of x $\underset{\approx}{S_\theta,\alpha_f(I)}$ y.

If we put f(x)=x for x≥0, we write $x \underset{\approx}{S_{\theta,f}(I)} y$ instead of $x \underset{\approx}{S_{\theta,\alpha_f}(I)} y$.

If we take α=1 , we write $x \underset{\approx}{S_{\theta}(I)} y$ instead of $x \underset{\approx}{S_{\theta,\alpha}(I)} y$.

We now prove some inclusion theorems.

Theorem 3.1. Let I⊂P(N) be a non-trivial ideal in N , f be any modulus, θ = (k_r) be a lacunary sequence, p=(p_k) be a sequence of positive real numbers and 0 < α ≤ β ≤1 then

(i) if $x \underset{\approx}{w,\alpha_f^p(I)} y$ implies $x \underset{\approx}{w,\beta_f^p(I)} y$

(ii) if $x \underset{\approx}{N_\theta,\alpha_f^p(I)} y$ implies $x \underset{\approx}{N_\theta,\beta_f^p(I)} y$

(iii) if $x \underset{\approx}{S_\theta,\alpha_f(I)} y$ implies $x \underset{\approx}{S_\theta,\beta_f(I)} y$.

Proof.(i-iii) Let 0<α≤β≤1 , $x \underset{\approx}{w,\alpha_f^p(I)} y$, $x \underset{\approx}{N_\theta,\alpha_f^p(I)} y$ and $x \underset{\approx}{S_\theta,\alpha_f(I)} y$. It is easily that $\frac{1}{n^\beta} \le \frac{1}{n^\alpha}$ for all n. Since $h_r = k_r - k_{r-1} \to \infty$,we can actually choose r, so that $h_r^\alpha \le h_r^\beta$ and $\frac{1}{h_r^\beta} \le \frac{1}{h_r^\alpha}$. Hence

$$\frac{1}{n^\beta}\sum_{k=1}^{n}[f(|\frac{x_k}{y_k}-L|)]^{p_k} \le \frac{1}{n^\alpha}\sum_{k=1}^{n}[f(|\frac{x_k}{y_k}-L|)]^{p_k}$$

$$\frac{1}{h_r^\beta}\sum_{k\in I_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k} \le \frac{1}{h_r^\alpha}\sum_{k\in I_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k} \text{ and}$$

$$\frac{1}{h_r^\beta} |\{k\in I_r : f(|\tfrac{x_k}{y_k}-L|)\ge\varepsilon\}| \le \frac{1}{h_r^\alpha} |\{k\in I_r : f(|\tfrac{x_k}{y_k}-L|)\ge\varepsilon\}|$$

Thus,

$$\{n\in N: \frac{1}{n^\beta}\sum_{k=1}^{n}[f(|\frac{x_k}{y_k}-L|)]^{p_k}\ge\varepsilon\} \subseteq \{n\in N; \frac{1}{n^\alpha}\sum_{k=1}^{n}[f(|\frac{x_k}{y_k}-L|)]^{p_k}\}\in I$$

$$\{k\in I_r; \frac{1}{h_r^\beta}\sum_{k\in I_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k}\ge\varepsilon\} \subseteq \{k\in I_r; \frac{1}{h_r^\alpha}\sum_{k\in I_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k}\ge\varepsilon\}\in I$$

$$\{n\in N; \frac{1}{h_r^\beta} |\{k\in I_r : f(|\tfrac{x_k}{y_k}-L|)\ge\varepsilon\}|\ge\gamma\} \subseteq \{n\in N; \frac{1}{h_r^\alpha} |\{k\in I_r : f(|\tfrac{x_k}{y_k}-L|)\ge\varepsilon\}|\ge\gamma\}\in I.$$

Therefore respecticely $x \underset{\approx}{w,\beta_f^p(I)} y$, $x \underset{\approx}{N_\theta,\beta_f^p(I)} y$ and $x \underset{\approx}{S_\theta,\beta_f(I)} y$.

Setting β=1, in Theorem 1 gives the following result .

Corollary. Let f be any modulus, θ=(k_r) be a lacunary sequence, p=(p_k) be a sequence of positive real numbers and 0 < α ≤ 1 , then

(i) if $x \underset{\approx}{w,\alpha_f^p} y$ implies $x \underset{\approx}{w_f^p(I)} y$

(ii) if $x \underset{\approx}{N_\theta,\alpha_f^p} y$ implies $x \underset{\approx}{N_\theta f^p(I)} y$

(iii) if $x \overset{S_\theta, \alpha_f}{\approx} y$ implies $x \overset{S_{\theta f}(I)}{\approx} y$.

We have this section with the following Theorem to show that the relation between $\alpha_f^p(I)$- lacunary equivalence with order α and strong $\alpha_f^p(I)$- lacunary equivalence with order α.

Theorem 3.2. Let I⊂P(N) be a non-trivial ideal in N , f be a modulus function, θ=(k_r) be a lacunary sequence,0<α≤1 and

$0<h=\inf_k p_k \le p_k \le \sup_k p_k = H <\infty$, if $\lim_{t\to\infty} \frac{f(t)}{t} = \beta >0$, then $x \overset{w, \alpha_f^p(I)}{\approx} y$ implies $x \overset{w, \alpha^p(I)}{\approx} y$

Proof. If $\lim_{t\to\infty} \frac{f(t)}{t} = \beta >0$, then f(t) ≥βt for all t>0.Let $x \overset{w, \alpha_f^p(I)}{\approx} y$,clearly

$$\frac{1}{n^\alpha}\sum_{k=1}^{n}[f(|\frac{x_k}{y_k} - L|)]^{p_k} \ge \frac{1}{n^\alpha}\sum_{k=1}^{n}[\beta(|\frac{x_k}{y_k} - L|)]^{p_k}$$

$$\ge \min\{\beta^h, \beta^H\}\frac{1}{n^\alpha}\sum_{k=1}^{n}[|\frac{x_k}{y_k} - L|]^{p_k}$$

it follows that for each ε>0, we have

$$\{n\in N;\ \frac{1}{n^\alpha}\sum_{k=1}^{n}[|\frac{x_k}{y_k} - L|]^{p_k} \ge \varepsilon\} \subseteq \{n\in N;\ \frac{1}{n^\alpha}\sum_{k=1}^{n}[f(|\frac{x_k}{y_k} - L|)]^{p_k} \ge \min\{\beta^h, \beta^H\}\} \in I.$$

Since $x \overset{w, \alpha_f^p(I)}{\approx} y$, it follows that the later set belongs to I, and therefore, the theorem is proved.

Theorem 3.3. Let I⊂P(N) be a non-trivial ideal in N , f be a modulus function, θ=(k_r) be a lacunary sequence,0<α≤1 and $0<h=\inf_k p_k \le p_k \le \sup_k p_k = H <\infty$, then

if $\lim_{t\to\infty} \frac{f(t)}{t} = \beta >0$, then $x \overset{N_\theta, \alpha_f^p(I)}{\approx} y$ implies $x \overset{N_\theta, \alpha^p(I)}{\approx} y$.

Proof. The proof of Theorem 3.2 is very similar to the Theorem 3.1.Then we omit it.

The next theorem shows the relationship between the strong $\alpha_f^p(I)$- lacunary equivalence with order α and the strong $\alpha_f^p(I)$- equivalence with order α.

Theorem 3.4. Let I⊂P(N) be a non-trivial ideal in N , f be a modulus function, θ=(k_r) be a lacunary sequence,0<α≤1 and $p=(p_k)$ be a sequence of positive real numbers , then

(i) if $\sup_r \frac{1}{k_{r-1}^\alpha}\sum_{m=1}^{r}(k_m - k_{m-1})^\alpha = B(say) <\infty$ then $x \overset{N_\theta, \alpha_f^p(I)}{\approx} y$ implies $x \overset{w, \alpha_f^p(I)}{\approx} y$

(ii) if $\sup_r \frac{k_r}{h_r^\alpha} = C(say) <\infty$ then $x \overset{w, \alpha_f^p(I)}{\approx} y$ implies $x \overset{N_\theta, \alpha_f^p(I)}{\approx} y$.

Proof.(i). Now suppose that $x \overset{N_\theta, \alpha_f^p(I)}{\approx} y$ and ε>0.Let $A=\{r\in N;\ \frac{1}{h_r^\alpha}\sum_{k\in I_r}[f(|\frac{x_k}{y_k} - L|)]^{p_k} <\varepsilon\}$,

Hence,for all j∈A, we have $H_j = \frac{1}{h_j^\alpha}\sum_{k\in I_j}[f(|\frac{x_k}{y_k} - L|)]^{p_k} <\varepsilon$. Choose n is any integer with $k_r \ge n > k_{r-1}\}$ where r∈A. Now write

$$\frac{1}{n^\alpha}\sum_{k=1}^{n}[f(|\frac{x_k}{y_k} - L|)]^{p_k} \le \frac{1}{k_{r-1}^\alpha}\sum_{k=1}^{k_r}[f(|\frac{x_k}{y_k} - L|)]^{p_k}$$

$$\leq B\frac{1}{h_m^{\alpha}}\sum_{k\in I_m}[f(|\frac{x_k}{y_k}-L|)]^{p_k}$$

$\{n\in N;\ \frac{1}{n^{\alpha}}\sum_{k=1}^{n}[f(|\frac{x_k}{y_k}-L|)]^{p_k}\geq\varepsilon\}\subseteq\{r\in N;\ \frac{1}{h_r^{\alpha}}\sum_{k\in I_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k}\geq\varepsilon/B\}\in I.$

which yields that $x \overset{w,\alpha_f^p(I)}{\approx} y$.

(ii). Let $x \overset{w,\alpha_f^p(I)}{\approx} y$.

$$\frac{1}{h_r^{\alpha}}\sum_{k\in I_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k}=\frac{1}{h_r^{\alpha}}\sum_{k=1}^{k_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k}-\frac{1}{h_r^{\alpha}}\sum_{k=1}^{k_{r-1}}[f(|\frac{x_k}{y_k}-L|)]^{p_k}$$

$$\leq\frac{1}{h_r^{\alpha}}\sum_{k=1}^{k_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k}$$

$$=\frac{k_r}{h_r^{\alpha}k_r}\sum_{k=1}^{k_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k}$$

$$<C\frac{1}{k_r}\sum_{k=1}^{k_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k}$$

$\{r\in N;\ \frac{1}{h_r^{\alpha}}\sum_{k=1}^{k_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k}\geq\varepsilon\}\subseteq\{r\in N;\ \frac{1}{k_r}\sum_{k=1}^{k_r}[f(|\frac{x_k}{y_k}-L|)]^{p_k}\geq\varepsilon/C\}\in I.$

which yields that $x \overset{N_\theta,\alpha_f^p(I)}{\approx} y$.

Now we give relation between asymptotically α- lacunary statistical equivalence and strong α_f^p (I)- lacunary equivalence with order α.Also we give relation between asymptotically α_f - lacunary statistical equivalence and strong α_f^p(I)- lacunary equivalence with order α.The Proofs will not be given.

Theorem 3.5. Let I⊂P(N) be a non-trivial ideal in N , f be a modulus function, θ=(k_r) be a lacunary sequence,0<α≤1 and $0<h=\inf_k p_k\leq p_k\leq\sup_k p_k=H<\infty$, then $x \overset{N_\theta,\alpha_f^p(I)}{\approx} y$ implies $x \overset{S_\theta,\alpha(I)}{\approx} y$.

Theorem 3.6. Let I⊂P(N) be a non-trivial ideal in N , f be a modulus function, θ=(k_r) be a lacunary sequence,0<α≤1 and $0<h=\inf_k p_k\leq p_k\leq\sup_k p_k=H<\infty$, then $x \overset{N_\theta,\alpha_f^p(I)}{\approx} y$ implies $x \overset{S_\theta,\alpha_f(I)}{\approx} y$,

Let p_k =p for all k , t_k =t for all k and 0<p≤t. Then it follows following Theorem.

Theorem 3.7. Let f be any modulus, θ=(k_r) be a lacunary sequence, p=(p_k) be a sequence of positive real numbers,and 0 < α ≤ 1 then $x \overset{N_\theta,\alpha_f^t(I)}{\approx} y$ implies $x \overset{N_\theta,\alpha_f^p(I)}{\approx} y$,

Conclusion

The relations we have achieved are generally parallel to the literature. However, some of the relations in the literature have not been found

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CHARACTERIZATION OF THERMOSTABLE β-GALACTOSIDASE FROM *Anoxybacillus ayderensis* AND OPTIMAL DESIGN FOR ENZYME INHIBITION USING SEMIPARAMETRIC EIV MODELS

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Abstract: The thermostable β-galactosidase from *Anoxybacillus ayderensis* was partially purified by Sephadex G-75 with a fold purification of 14.4 and a yield of 13.4%, respectively. The optimal activity and stability of β-galactosidase was pH 9.0 and a temperature of 60 °C. The molecular weight of the subunits was estimated as 90 kDa by sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS-PAGE). The effect of different concentrations of chelating agents (ethylenediaminetetraacetic acid, 1,10 phenantroline), some chemicals (dithiothreitol, phenylmethlysulfonyl fluoride, 4-Chloromercuribenzoic acid, N-ethylmaleimide, iodoacedemide and β-mercaptoethanol) and divalent metal ions (Mg^{2+},Ca^{2+}, Cu^{2+} and Zn^{2+}) on enzyme activity was assayed. According to the results, the thermostable β-galactosidase was significantly activated by Ca^{2+} while inhibited Zn^{2+} and Cu^{2+} ions. In addition, the enzyme activity was inhibited by EDTA, PCMB, N-ethylmaleimide and 1,10 phenantroline. We used a new semiparametric errors in variables model in order to explain the combined effect of the chemicals on enzyme activity, considering that there is a measurement error in nonparametric variable and there is no information at all about the error distribution and compared the no measurement error case and errors in variables case.

Keywords: β-galactosidase, characterization, inhibition, EIV model

Introduction

Enzymes are used in a number of new applications such as food, feed, agriculture, paper, leather and textile industries, which is costly. At the same time fast technological developments; The chemical and pharmaceutical industry, which includes enzyme technology, which is a stronger trend in health, energy, raw materials and environmental issues (Beilen and Lie 2002).

With the advancement of biotechnology and the purification of enzymes, the number of enzyme applications has increased a lot and many possibilities for industrial processes have emerged with the availability of thermostable enzymes. Thermostable enzymes, which are mainly isolated from thermophilic organisms, find many commercial applications due to their general internal stability (Haki and Rakshit 2003).

β-Galactosidase is found in various microorganisms, plant and animal tissues in nature. The commercial importance of microbial β-galactosidases is greater when compared to other sources because of their easy control of their production and their high productivity. (Juajun et al. 2010).

In this study, we purified thermostable β-galactosidase from thermophilic *Anoxybacillus ayderensis* and also we tried to explained the combined effect of the some chemicals on b- galactosidase activity using semi-parametric errors in variables model.

Materials and Methods

Moderately thermophilic *Anoxybacillus ayderensis* (NCBI GenBank database accession number is KP992869) was obtained from Dicle University and it was grown in 100 mL Luria-Bertani medium (LB) incubated at 50 °C for 24 h. After incubation, cells were harvested by centrifugation (8200 g, 30 min, 10 °C) and were lyzed by ultrasonicator (for 3 times 25 sec.) and centrifuged. Supernatants (crude extracts) containing the β-galactosidase were used for purification steps. β-galactosidase purification and anzyme activity determined with *o*-nitrophenyl-β-D-galactopyranoside (*o*-NPG, Sigma) method according to Matpan Bekler et al. (2017). The protein content was determined by the Lowry method (1951) using bovine serum albumin (BSA) as a standard. The molecular weight of β-galactosidase was estimated by SDS-PAGE (Sodium Dodecyl Sulphate Polyacrylamide Gel Electro-phoresis) according to Laemmli (1970) and zymography analysis was performed as described by Gül-Güven et al. (2007).

After purification steps, the purified enzyme was characterized. Optimum pH was determined under standard assay conditions using *o*-NPG (pH 4.0–10.0). For the pH stability, the purified enzyme was incubated at 60 °C for 1 h in different buffers (4.0 to 11.0). Optimum temperature was determined under standard assay conditions using *o*-NPG at temperatures ranging from 20 to 90 oC. The thermostability was incubated at 60 °C and 70 °C for different time (0-120 min). The unheated purified enzyme was taken as 100%. The remaining β-galactosidase activity was measured under standard assay conditions.

The effect of chelating agent (1,10- phenanthroline: phen), some chemicals dithio-threitol (DTT), phenylmethylsulfonyl fluoride (PMSF), N-ethylmaleimide (NEM), iodoacetamide (Iod A) and *β*-Mercaptoethanol (*β*-Mer) and divalent metal ions (Mg^{2+}, Ca^{2+}, Cu^{2+}, Hg^{2+}) on *β*- galactosidase activity was assayed using 1.5 mM *o*-NPG solution in 0.1 M sodium phosphate buffer (pH 9.0) at 60 °C. The partially purified enzyme was pre-incubated with all agents and then enzyme activity was measured. The combined effects of some chemicals on *β*- galactosidase activity by *Anoxybacillus ayderensis* were studied using semiparametric errors in variables methodology as described by Matpan Bekler et al (2017).

Results and Discussion

The β-galactosidase was purified as described in materials and methods. The purification steps resulted in 14.4 fold purification and a yield of 13.4% (Table 1).

Table 1: Purification steps of β-galactosidase

	Total protein (mg)	Total activity (U)	Specific activity (U/mg)	Purification (fold)	Yield (%)
Crude extract	201,6	34943,8	173,3715	1	100
Ammonium sulphate precipitation and dialysis	16,2	16215,2	1003,118	8,0	46,4
Sephadex G-75	2,7	4683,9	1721,989	14,4	13,4

The purified β-galactosidase was subjected to SDS-PAGE analysis and BNG staining (Figure 1a, b). Data of the SDS-PAGE (Figure 1a, lane 2) showed that the purified β-galactosidase had a molecular weight of 90 kDa.

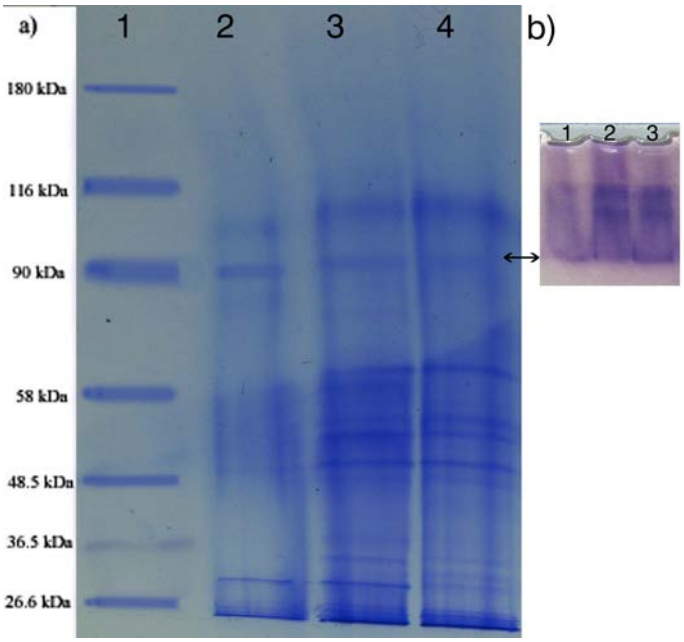

Figure 1. SDS-PAGE CBB-staining (a) BNG-staining (b) analysis of β-galactosidase from *Anoxybacillus ayderensis*. a: Lane 1, molecular mass markers [Sigma SDS7B2: a2-macroglobulin (180 kDa), β- galactosidase (116 kDa), lactoferrin (90 kDa), pyruvate kinase (58 kDa), fumarase (48.5 kDa), lactic dehydrogenase (36.5 kDa), triosephospate isomerase (26.6 kDa)]; lanes 2 CBB-staining of partially purified β- galactosidase (Sephadex G-

75), 3b: BNG-staining lane 1, crude extract; lane 2, ammonium sulphate precipitation and dialysis; lane 3, Sephadex G-75.

Matpan Bekler et al. (2017) reported that the molecular weight of purified β-galactosidases from *Anoxbacillus* were 68.5 kDa. According to Uniport Protein sequence databases (http://www.uniprot.org/), molecular weight of β-galactosidases belonging to *Anoxybacillus* are between 49.1-116.7 kDa.

The optimum pH for β-galactosidase activity was found to be 9.0 (Figure 2). The enzyme was also stable at pH 9.0 (Figure 3).

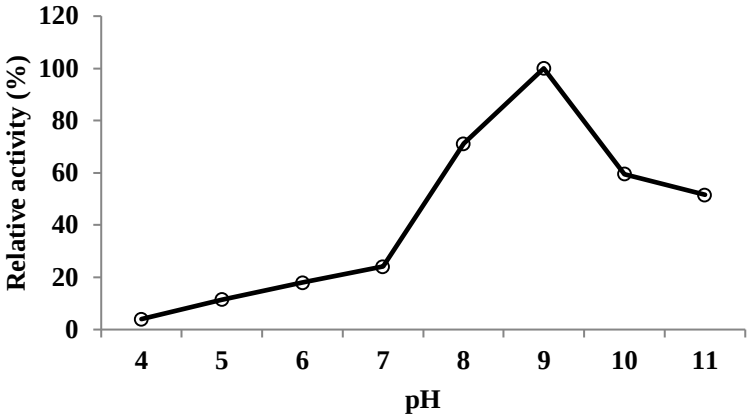

Figure 2. Effect of pH on β-galactosidase.

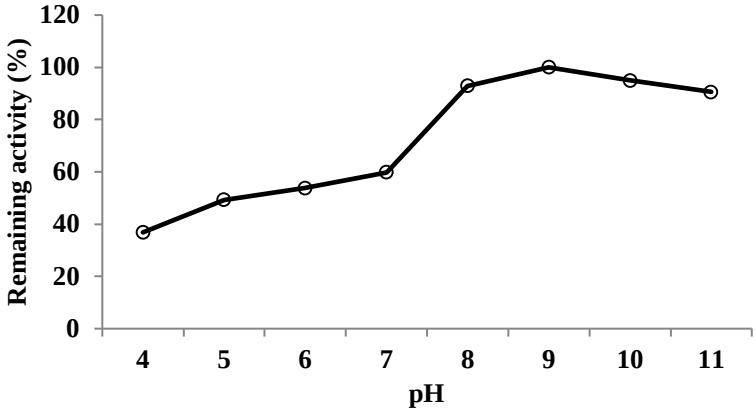

Figure 3. Effect of pH on stability of β-galactosidase.

The purified β-galactosidase activity increased with temperature up to 60 °C, after 70 °C the enzyme activity decreased (Figure 4).

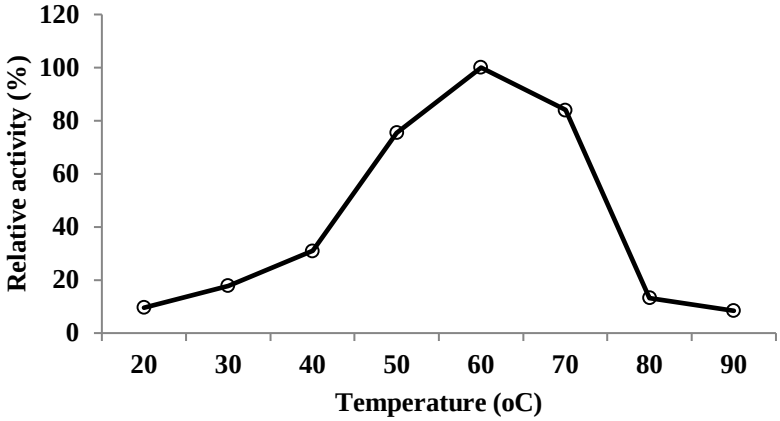

Figure 4. Effect of temperature on β-galactosidase.

Vetere and Paoletti (1998), Chakraborti et al. (2000) and Di Lauro et al. (2008) reported optimum temperature of β-galactosidase activity was 60 °C for *B.circulans*, *Bacillus sp*. and *A. acidocaldarius*, respectively. The enzyme is highly stable at 60 °C for 120 min (Figure 5). Thermostable β-galactosidases are tolerant to immobilization and pasteurization have an economic advantage (Ohtsu et al. 1998).

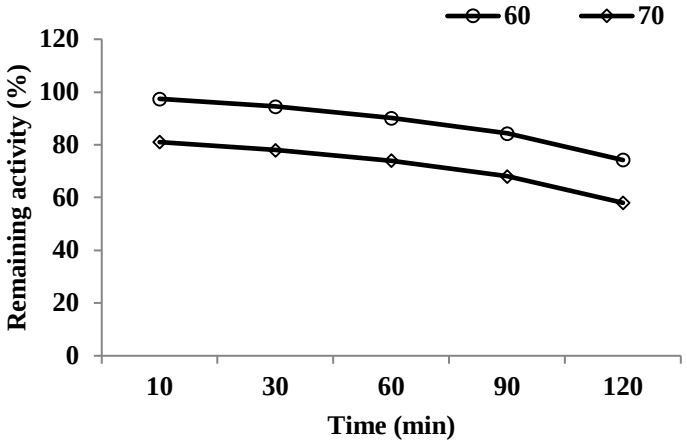

Figure 5. Effect of temperature on stability of β-galactosidase.

the effect of some metal ions on enzyme activity In Table 2 we can see that. The enzyme activity was significantly inhibited by divalent metal ions Cu^{2+} and Zn^{2+} in the total activity result. In previous studies,Ladero et al. (2002) and Shipkowski et al. (2006) stated that Cu^{2+} ions inhibited the enzyme activity. In addition, Ca^{2+} (at 1 mM to 20 mM) activated the enzyme activity while addition of EDTA to assay mixute leads to enzyme inactivation. It is known that enzyme activity in most β-galactosidases increases with Ca^{2+} (Berger et al. 1997) β-galactosidase is considered a metalloenzyme since treatment of the unfolded protein with chelating agents and subsequent refolding experiments ought to be carried out in order to leave out the structural and catalytic metal ions on the enzyme.

Table 2: Effect of some metal ions on β-galactosidase

	Percentage activity retained (%)				
Concentrations / Metal	**1 mM**	**2 mM**	**5 mM**	**10 mM**	**20 mM**
EDTA	68	64	63	60	58
CaCl2	108	111	114	132	178
MgCl2	94	94	94	94	95
ZnCl2	48	46	46	46	39
CuCl2	29	24	23	11	6

Optimal combinations of β-Mer and Iod A for maximum β-galactosidase activity was determined as 8 mM β-Mer and 2 mM Iod A while for minimum β-galactosidase activity was determined as 4 mM β-Mer and 10 mM Iod A. (Fig. 6) The optimal combinations of DTT and Iod A for maximum β-galactosidase activity was determined as 8 mM DTT and 8 mM Iod A and for minimum β-galactosidase activity was determined as 1 mM DTT and 4 mM Iod A (Fig. 7). The combined effect of DTT and β-Mer for maximum β-galactosidase activity was determined as 8 mM DTT and 8 mM β-Mer and minimum β-galactosidase activity was determined as 4 mM DTT and 4 mM β-Mer (Fig. 8). According to our experimental design, in Fig. 9, the combined effect of PMSF and NEM on maximum activity was obtained at 2 mM PMSF and 8 mM NEM. Therefore, it was concluded that no thiol or carboxylic residue are essential for its catalytic activity. It can be seen that there is also a decrease in enzyme activity at 4 mM PMSF and 1 mM NEM because of the measurement error.

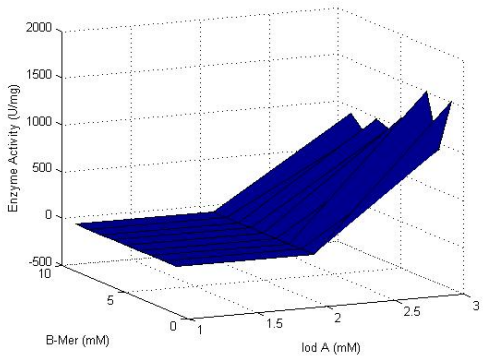

Figure 7: Response surface plot showing the effect on β-mer, Iod A and their mutual effect on the β-galactosidase activity.

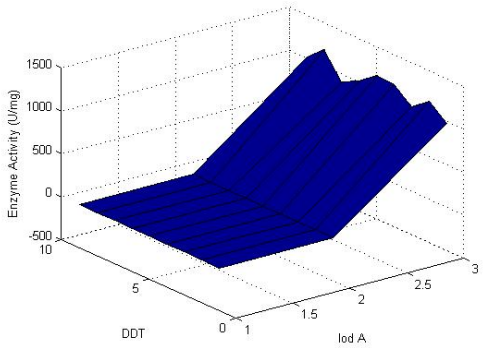

Figure 8: Response surface plot showing the effect on DTT, Iod A and their mutual effect on the β-galactosidase activity.

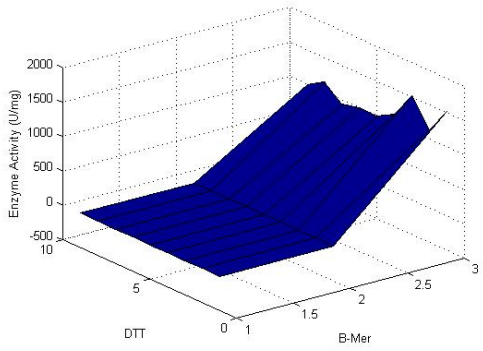

Figure 6: Response surface plot showing the effect on DTT, β-mer and their mutual effect on the β-galactosidase activity.

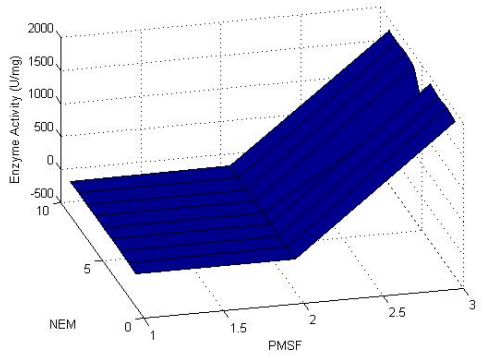

Figure 6: Response surface plot showing the effect on NEM, PMSF and their mutual effect on the β-galactosidase activity.

Conclusion

The main goal of this study was to purify, characterize and reveal the effect of concentrations of some chemicals on β-galactosidase activity and for that purpose experimental design in semiparametric regression method was used as variable of nonparametric part had unknown measurement error. The significant achievement of the present work was to enable us to have no information about a measurement error in nonparametric variable and the combined effect of the six chemicals on the enzyme activity. The method that was selected for the optimization of chemical concentration was found to be quite simple, adequate, and taking less time and material.

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CHEMICAL MODIFICATION, CHARACTERIZATION, AND HEAVY METAL ADSORPTION OF CELLULOSE-BASED NATURAL FIBERS

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Abstract: The introduction of heavy metal ions into aquatic environment by industrial waste, agricultural waste, and natural disposals is a major environmental concern. Several methods such as precipitation, reverse osmosis, and bioremediation have been used for removal of heavy metals from wastewater and environmental samples but such techniques are expensive, time-consuming, or results in yielding toxic chemicals. Alternatively, adsorption is a preferred method as it combines both environmental and economic advantages. This paper presents the development of adsorbents by chemical modification of cellulose-based natural fibers. Cotton fibers, which are rich in cellulose, were modified by tethering different ligands (including cystamine and polyamines) and measured their efficacy in removing heavy metals (such as Cd(II), Cu(II), Hg(II), Pb(II), and Zn(II) ions) from stimulated contaminated water. The fibers were characterized by FTIR, SEM, EDS, and TGA and their efficacy for removal of heavy metals was investigated using stimulated polluted water with either Cd(II), Hg(II), or Pb(II) metal ions. The results show that the metal-removal capacity of cystamine-modified cotton increased by ~200% and of polyamines-modified cotton by ~400% for Cd(II), and Pb(II) metal ions.

Keywords: Heavy Metals, Cotton, Wastewater, Adsorbent, Natural Fibers, Cellulose.

Introduction

The introduction of heavy metal ions (such as Pb, Hg, Cd, Cu, Zn, Ni, Co, Fe) into the aquatic environment from industrial, agricultural, and natural disposals is a major environmental and health concern. Each year, millions of tons of these metals are released into the environment by one or the other of the abovementioned artificial processes alone (Hubicki & Kołodyńska, 2012). Although most of these metals are required by the plant and animal bodies in low amounts, they can become harmful if present in increased amounts. Lead exposure, for example, can severely damage internal body organs and cause health issues such as kidney and brain damage, and anemia (Pagliuca & Mufti, 1990). Exposure to mercury can lead to health issues such as kidney damage, pneumonia and lung damage, and disorders such as dyslexia and attention deficit hyperactivity disorder (ADHD) (Weiss & Landrigan, 2000), while exposure to cadmium released into the atmosphere by industries causes cadmium(II) to accumulate in the digestive organs in the body and harm the kidneys and respiratory tract (Friberg, 1985). The recommended limits for lead(II), mercury(II), and cadmium(II) in drinking water are 0.005 ppm, 0.0005 ppm and 0.003 ppm, respectively (Dabrowski, Hubicki, Podkoscielny, & Robens, 2004; Hubicki & Kołodyńska, 2012; O'Connell, Birkinshaw, & O'Dwyer, 2008).

Over the years, several techniques have been developed to remove heavy metals from the environment, such as ion exchange, adsorption, reverse osmosis, electrolytic reduction, precipitation, and solvent extraction (Hubicki & Kołodyńska, 2012). However, most of these techniques are either expensive or energy-demanding, thus great interest has been focused on using renewable natural fibers as adsorbents of heavy metals (Mosa, El-Ghamry, & Truby, 2011; Qu et al., 2009; Shukla, Pai, & Shendarkar, 2006; Xie, Jing, Zhao, & Zhang, 2011). Ideally, for a fiber to be an efficient adsorbent material, it should be rich in functional groups containing atoms such as oxygen, nitrogen or sulfur, which can coordinate with heavy-metal ions. One good example of such a natural material is cellulose, which is a linear homopolymer solid composed of D-anhydroglucopyranose monomeric units assembled via β-(1,4)-glycosidic bonds. Cellulose is mechanically strong, hydrophilic, biocompatible and biodegradable, and with lignin, it accounts for most agricultural crops (Mosa et al., 2011; Qiu & Hu, 2013). Thus, plant materials such as rice straw, cotton, and maize stalks were found to be good adsorbents of heavy metals, with cotton stalk having the highest binding capacity (Mosa et al., 2011).

Herein, we report on the chemical-modification of cellulose present in natural cotton fibers to enhance the cotton's efficiency in removing heavy metals form water. The cellulose in cotton was chemically tethered to nitrogen- and sulfur-rich ligands which have binding affinity to heavy metals such as lead and mercury; the ligands used were triethylenetetramine, tetraethylenepentamine, pentaethylenehexamine, and cystamine. The fibers were then used to remove heavy metals from synthetic polluted water where 100-400% increase in the metal-removal capacity of the modified fibers was observed in comparison to unmodified cotton fibers.

Materials and Methods

Materials and Equipment: The metal solutions used were at 100, 200, and 300 ppm mercury(II), lead(II) and cadmium(II) solutions, which were separately prepared using mercury(II) acetate, lead nitrate and cadmium chloride salts, respectively, with deionized water. Metal salts from BDH and/or Panreac (Barcelona, Spain). Acidic conditions (pH= 6.0 ± 0.1) were maintained for all metal solutions using HNO_3 (0.1 M). pH was measured using PerpHecT Basic Benchtop Model Orion 320 pH meter (Thermo- Orion, Loughborough, UK). Infra-red (IR) spectra were recorded using KBr discs on an FTIR spectrometer (from PerkinElmer, USA). Samples were shaken at 25 °C using a ThermoShaker Edmund Buhler KS-15/TH-15, Germany. Thermo-gravimetric measurements were performed on a TGA 4000 Thermogravimetric Analyzer (TGA) from PerkinElmer USA. All measurements were performed under N2 gas, and the temperature ramp was set at 10 °C/ min. Scanning Electron Microscope (SEM) was performed on a Tescan VEGA III LMU (Czech Republic) with Oxford Instruments EDS surface analysis capability. SEM-Resolution: 3 nm in High vacuum Mode (30 kV); Low Vac and BEI Resolution: 5 nm; Magnification 4 x 1,000,000X; EDS Detector Resolution: 127 EV; EDS Detector Size; 10 mm; EDS Detection range: Be to U with low sensitivity for atoms below Na. Metal analysis was carried out on Inductively Coupled Plasma (ICP) instrument.

Synthesis of Oxidized Cellulose: Cotton (20.00 g) was soaked in a solution of sodium periodate (10.0 g $NaIO_4$ in 1000 mL of deionized water) and stirred continuously at a temperature ~65 °C for 1 hour. After cooling to room temperature, the cotton was filtered, washed with ice cold deionized water, and dried under vacuum for 12 hours at room temperature.

Synthesis of Modified Cellulose: Oxidized cotton (2.000 g) was added to a solution (200 mL) of sodium carbonate (35 mM) and the ligand (45 mM). The mixture was allowed to stir for 24 hours at room temperature before it was filtered, washed with ice cold deionized water, and dried under vacuum for 12 hours. The ligands used were triethylenetetramine, tetraethylenepentamine, pentaethylene-hexamine, and cystamine ligands.

Adsorption of Metals: Samples (100 mg) of the modified and the unmodified cotton were incubated with a solution of the metals (5 ml) at different concentrations (5.0 ppm, 20.0 ppm, 50.0 ppm, 100.0 ppm, and 200.0 ppm) at pH=6.0±0.1 for 12 hours at 25 °C while being swirled using a thermoshaker. The sample solutions were then filtered to remove the cotton, and the concentration of the metal in the filtrate was then measure using ICP.

Results and Discussion

The synthesis (Saravanan & Ravikumar, 2015) of the modified fibers started with the oxidation of the cellulose in the cotton with aqueous sodium periodate ($NaIO_4$) to form the dialdehyde groups which were then reacted with the amino group of the ligands in basic solution to form the imino linkage with the ligands (Figure 1). Physical examination of the modified cotton showed no visible change on the mechanical strength of the fiber. A closer examination of the fibers surface using SEM showed that the fibers of the oxidized cotton and those of the chemical modified cotton had slightly more rough surfaces than that of the unmodified cotton as depicted in Figure 2.

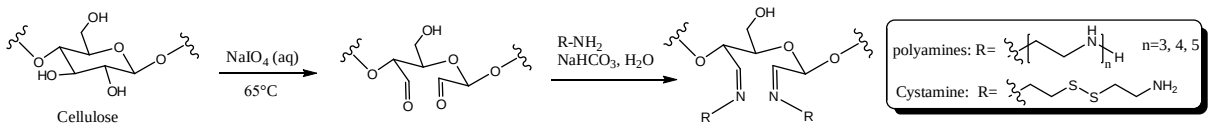


Figure 1. Synthetic scheme of the chemical modifications of the cotton fibers

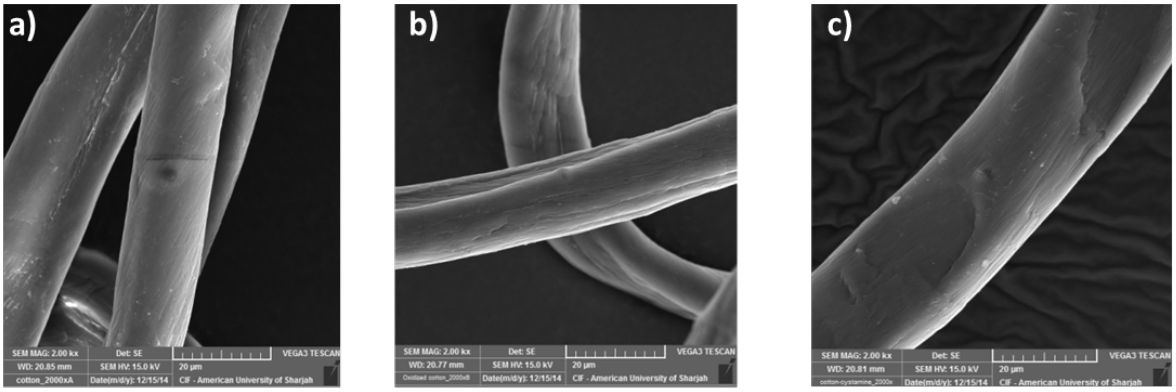


Figure 2. SEM images of the fibers' surface (2000x) of (a) unmodified cotton, (b) oxidized cotton and (c) cystamine-modified cotton

The changes in the IR spectra of the modified cotton indicated the attachment of the ligands to cellulose. Figure 3 shows the IR spectra of unmodified cotton, oxidized cotton, and triethylenetetramine-modified cotton fibers. The characteristic peaks of cellulose appear at 3300-3450 cm^{-1} due the stretching of O-H bonds and ~2900 cm^{-1} for the stretching of the non-aromatic C-H bonds. For the oxidized cotton spectra, along with these peaks, a new shoulder peak was observed at around 1737 cm^{-1} (Figure 3) due to the C=O bond stretch of the aldehyde along with peaks at around 1263 cm^{-1} and 810 cm^{-1}. These peaks disappeared when the ligand was attached and new peak appeared at ~3445 cm^{-1} (overlapping with that the OH band) corresponding to the stretching of N-H bonds in the ligand.

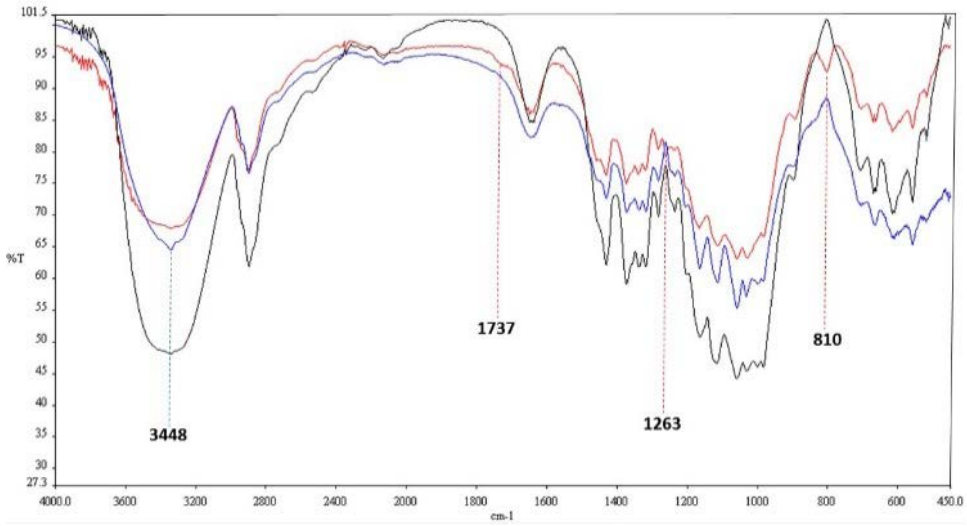


Figure 3. IR spectra of unmodified cotton (black), oxidized cotton (red) and triethylenetetramine-modified cotton (blue) fibers.

Furthermore, elemental analysis of the fiber surface using SEM-Energy Dispersive X-ray Spectroscopy (EDS) further supported the attachment of the ligand to the cotton surface. Figure 4 shows EDS spectra of unmodified cotton and cystamine-modified cotton fibers. The top spectra show the main elements present in cellulose fibers: carbon, hydrogen, and oxygen. After oxidation and attachment of the cystamine ligand, a new peak corresponding to sulfur appeared; the appearance of the peak was on the expense of the oxygen peak; the relative intensity of which decreased from 48.4% in the unmodified cotton to 45.7% in the cystamine-modified cotton.

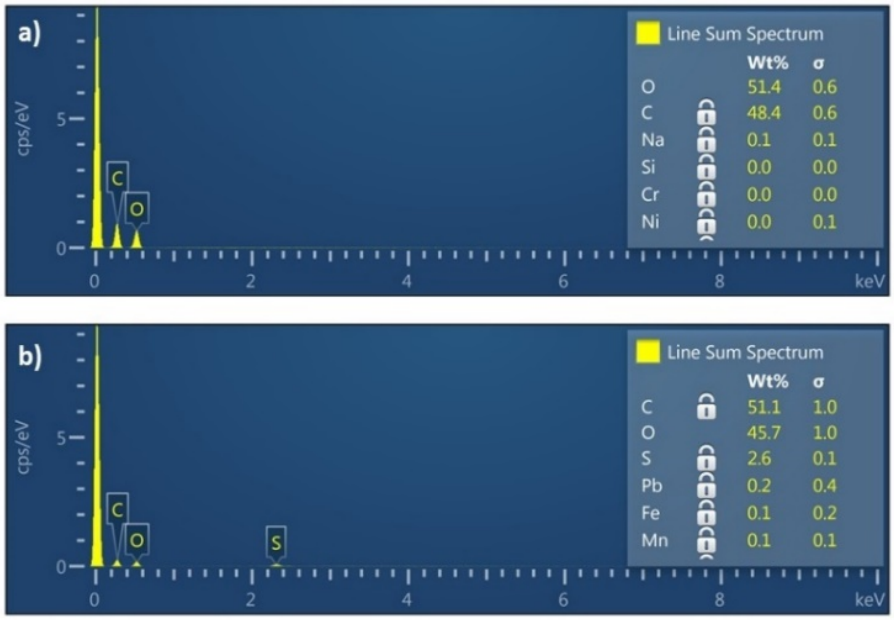


Figure 4. EDS spectra for (a) unmodified cotton and (b) cystamine-modified cotton fibers.

Thermal Gravimetric Analysis (TGA) of the ligand-modified cotton fibers showed that these were less thermally stable than the unmodified cotton fibers. The thermograms (Figure 5) of the fibers showed that unmodified cotton was stable up to 290 °C at which it started to decompose. However, all the modified fibers started to decompose at ~ 200°C and lost half their weight at ~365 °C. Cystamine-modified cotton showed a slightly different trend from the polyamine-modified fibers decomposing at a slower rate. The lower thermal stability of the modified fibers can be attributed to the weak imine bond which links the ligands to cellulose versus the C-C and C-O bonds present in the unmodified cotton (Saravanan & Ravikumar, 2015).

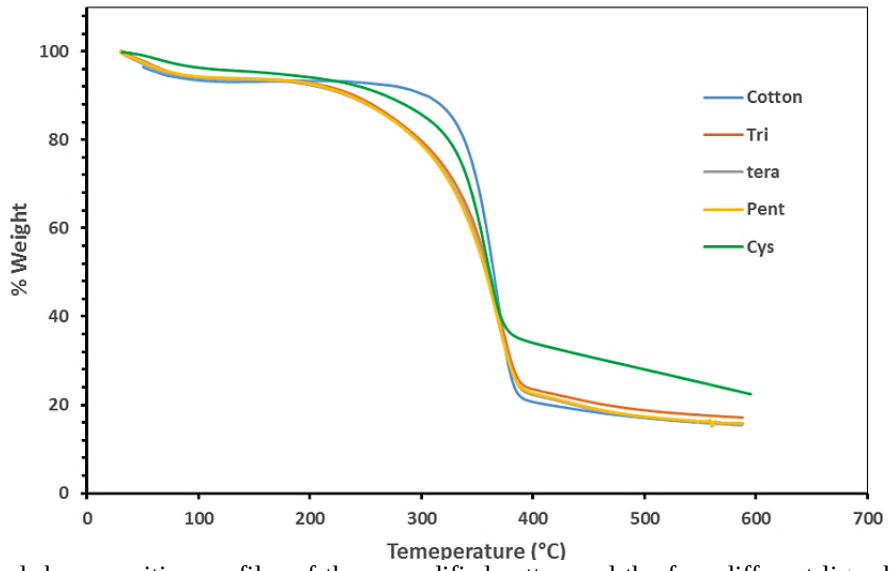


Figure 5. Thermal decomposition profiles of the unmodified cotton and the four different ligand-modified cotton fibers.

The ability of the modified fibers to remove metal ions from polluted water was evaluated through batch experiments where modified and non-modified fibers were soaked in solutions of different metals for 12 hours. Figure 6 shows the amount of Cd, Hg and Pb metal ion removed from 100 ppm solution using 20 g of fibers per one litter of solution. The fibers modified with the polyamines ligand removed about 50 % of Cd ions while fibers modified with

triethylenetetramine and cystamine removed around 50% of Hg and about 90% of Pb; however, non-modified cotton removed only 22% of Cd, 45% of Hg and 43% of Pb.

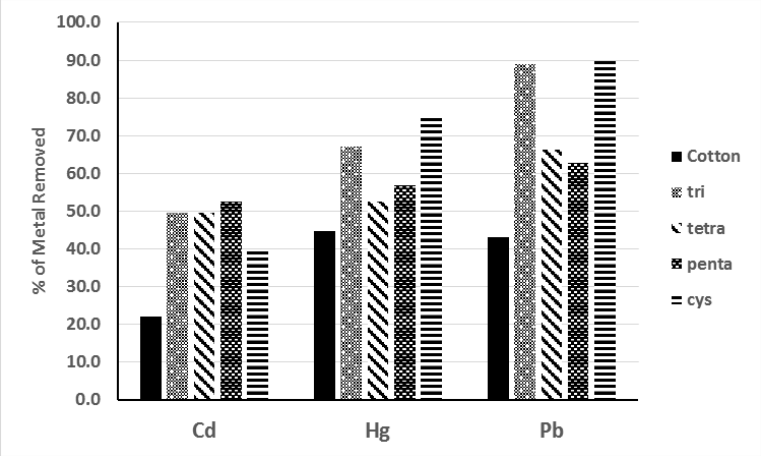
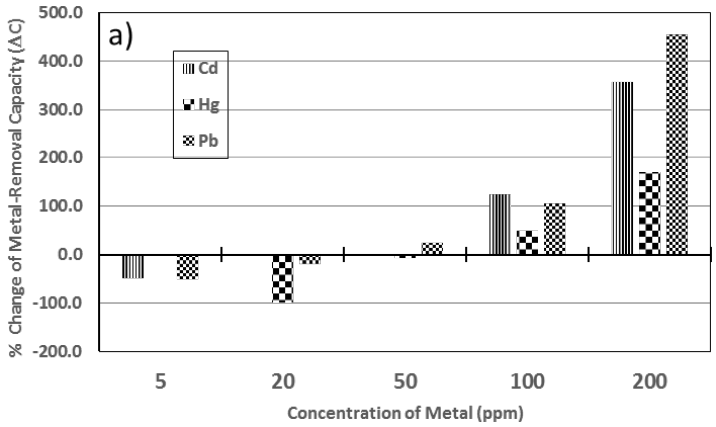


Figure 6. The % removal of the metal at 100 ppm concentration using the modified fibers at 20 g/L ratio.

The efficacy of the modified fibers to remove the metals was dependent on the concentration of the metal in solution. Figure 7 shows the relative change in metal-removal capacity (ΔC) of cotton as it was modified with triethylenetetramine and cystamine, respectively. The percentage change of metal-removal capacity was calculated according to (1):

$$\Delta C = [\ (C_f - C_o) / C_o] \times 100 \qquad (1)$$

where C_f is the metal-removal capacity of modified fiber (mg/g of metal/fiber), and C_o is the metal-removal capacity of non-modified fiber (mg/g of metal/fiber). The results showed that the chemical modification of cotton with triethylenetetramine had negative or insignificant effect on the metal-removal capacity at metal concentrations lower that 100 ppm; as metal concentration increased to 200 ppm, the metal-removal capacity increased by 350% for Cd, 150% for Hg and 450 % for Pb. Chemical modification of cotton with cystamine had insignificant effect on the metal-removal at 5 ppm and 20 ppm concentrations. As the concentration increased to 50 ppm, the loading capacity of Cd increased by 200 % and then it decreased to 140% and 110% at 100 ppm and 200 ppm, respectively. An opposite trend, however, was observed of Pb-removal capacity which increased by 30% at 50 ppm, 130% at 100 ppm and 190% at 200 ppm.



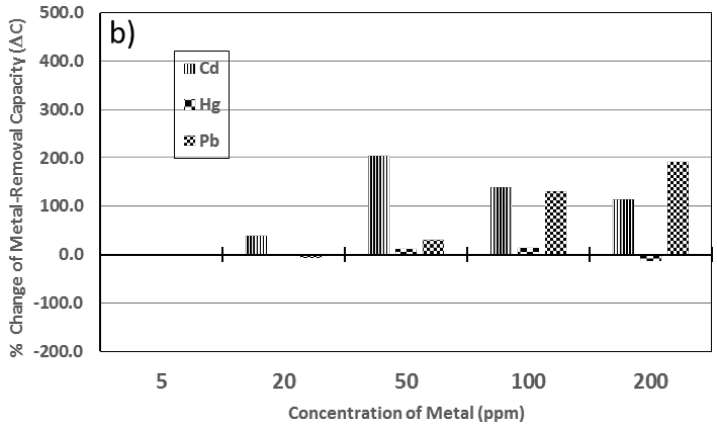


Figure 7. The % change of the metal-removing capacity (DC) of the cotton fibers upon modification with (a) triethylenetetramine and (b) cystamine.

Conclusion

The results of this report showed that chemical modification of cellulose natural fibers would enhance their efficacy as adsorbent for metal ions from polluted water. Further development of the procedures and investigations of other ligands and fibers could provide valuable tool for remediation of wastewater contaminated heavy metals at a relatively low cost.

Acknowledgements

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COMPARISON OF THE VIBRATION PROPERTIES OF MATERIALS AA2124/SiC/25p and ALUMINUM 6061-T6

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Abstract: Vibration characteristics of 2124A/SiC/25P metal matrix composites and aluminum 6061-T6 materials are compared with FEA. These materials, which are widely used in the aircraft industry is different vibration characteristics. These materials are usually subjected to dynamic loadings in aerospace. Vibration analysis that is determined from stress and frequency is important vibration analysis is important. Therefore, in this study, vibration response of two different materials were examined. Vibration analysis using a distributed point and forced damped was performed in the MSC ACTRAN program. Metal matrix composites according to the aluminum alloy were found to be more stable against vibration resistance.

Keywords: Metal Composite, Vibration, Analyses

Introduction

Aluminum and its alloys are used commonly in aerospace and transportation industries because of their low density and high strength to weight ratio. Especially Al-based Metal Matrix Composites (MMC) exhibit high strength, high elastic modulus, and improved resistance to fatigue, creep and wear; which make them promising structural materials for many industries (Kurt, 2011). The high cost of current MMCs compared to aluminum alloys has inhibited production on a large industrial scale (Kevorkijan, 1998). Aluminum 2124 alloy is a high strength wrought alloy generally used in aerospace industry for making structural components. Addition of high wear resistant ceramic particles, such as SiC, Al_2O_3, AlN, B_4C, TiC to the alloy is expected to increase the mechanical properties considerably. These MMCs suffer from the disadvantage of low ductility which is due to different reasons, like brittle interfacial reaction products, poor wettability, particle-matrix deboning or presence of porosity or particle clusters (Bauri, 2011; Uyyuru, 2006).

Composites are much sought after materials for a variety of industrial applications owing to their improved mechanical properties over the conventional alloys and materials. MMCs are the forerunners amongst different classes of composites. Al-based MMCs are well known for their high specific strength, hardness and wear resistance. During sliding against metals and abrasives, many studies have reported that MMCs exhibit better wear resistance than the un-reinforced alloys (Wai, 2000).

Table 1. AA2124/SiC/25p and ALUMINUM 6061-T6 composition

Cu	Mg	Mn	Si	Al
3.86	1.52	0.65	0.17	93.8

The plates used in this study are AA2124-T4 alloy matrix MMC strengthened with 25 % SiC particles (AA2124/SiC/25p-T4). This material was supplied by Aerospace Metal Composite Limited (UK) in form of billet with size of 400 mm × 260 mm × 50 mm. The MMC material was produced by powder metallurgy and mechanical alloying techniques followed by hot forging and tempering to T4 condition (solution heating at about 505 °C for 1 h, quenching in 25 % polymer glycol solution and room temperature aging for >100 h). The ultimate tensile strength of the base AA2124/SiC/25p-T4 MMC is of 454 MPa. The chemical composition of the AA2124/SiC/25p-T4 MMC is shown in Table 1. MMC plates of 130 mm × 50 mm × 3 mm size were cut from this billet by electro-discharge machining (EDM) technique with a feding rate of 2 mm/min. The microstructure of AA2124/SiC/25p MMC is shown in Fig. 1. In the AA2124 alloy matrix consists of an almost uniform distribution of the SiC reinforcement. In the longitudinal and transverse directions, the SiC particle-free regions are observed in AA2124/SiC/25p MMC. These particle-free regions were elongated along the forging direction. The forging process did not induce cracking in the reinforcement or at the interface SiC particles/matrix.

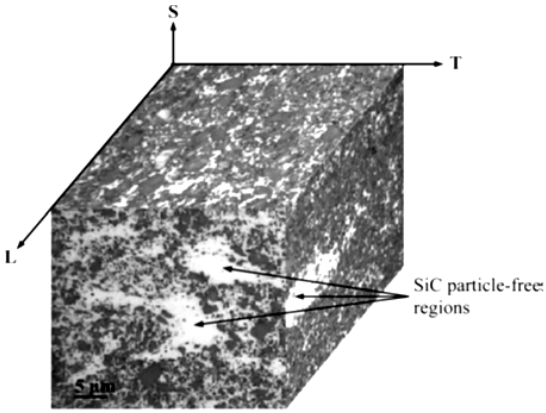

Fig 1. The AA2124/SiC/25p MMC microstructure in the longitudinal (L), transverse (T) and short transverse (S) directions after forging (Donskoy, 1998)

These MMC materials are using in aerospace industrial. The use of composite materials has been increasing consistently in aerospace applications due to their high specific stiffness and strength. However, the mechanical properties of composite materials.

Modal analysis is the most important part of the dynamic analysis. We can investigate natural frequencies and mode Shapes by using this modal analysis. Therefore, Finite Element Analysis (FEA) is commonly used for performing modal analysis. In this study presents a FEA for vibration properties of materials AA2124/SiC/25p and Aluminum 6061-T6.

Acoustic and vibration effect to cause various defects such as cracks, deboning, fatigue, and etc. lead to anomalous high levels of nonlinearity as compared with flawless structures. Actually, as long as the vibration function is known, the degraded image can be simulated with an original image. And by contrast of the theoretical features and the measured features of degraded images' spectrum, reliability of the simulation method can be validated. The Finite element methods and the simulation algorithm can control the degradation parameters accurately and flexibly and provide great convenience to the restoration of the degraded images (Tang, 2011; Wang, 2017; Tester, 2004).

In aerospace design and calculated, researcher have used software for expensive and nonrepeating application. As Circumferential, turbofan and structural geometrics object. ACTRAN is commonly acceptable in acoustic and vibration analyses software. And a lot of aerospace projects have been used for acoustic and vibration analyses (Asghar, 1993; Edward, 1994).

In this paper, using material in aircraft industry compression with new generation material. These results include only Finite element analyses. In future these results according to experimental results.

Materials and Methods

As we know finite element analysis have been used frequently for vibration analysis. Therefore, this study uses MSC.ACTRAN software for vibration properties of two materials which are AA2124/SiC/25p and aluminum 6061-T6. In the finite element modeling procedure, a simply sheet modeling was prepared 130x50x3 mm and meshed in MSC.ACTRAN program. This plate is connected to a single edge as cantilever beams. Applied force point selected random away from connected side (Fig. 3). Selected point used for two materials analyses. Also this analysis used total number of elements is 520 in FEM model. The properties of the materials used were given in Table 2.

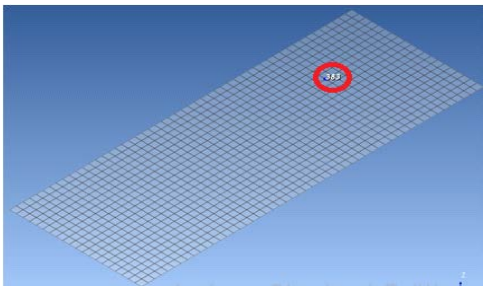

Fig 2. Location of applied frequency

Table 2. Material properties used in the analysis

	Elastic Module [GPa]	Poisson ratio	Density [g/cm3]
2124A/SiC/25p	115	0,3	2,88
Aluminum 6061-T6	69	0,33	2,7

The response of point and distributed forced damped vibrations applied to the plate was measured. Applied frequencies range is 0-5000 Hz.

Results and Discussion

In the analysis, it was detected natural frequency of the two different materials. Natural frequency of the AA2124/SiC/25p material is larger than the aluminum 6061-T6 (Fig. 3.). The material having a high natural frequency is known to be more rigid. This shows us that AA2124/SiC/25p material was later to undergo resonance and strength of the material.

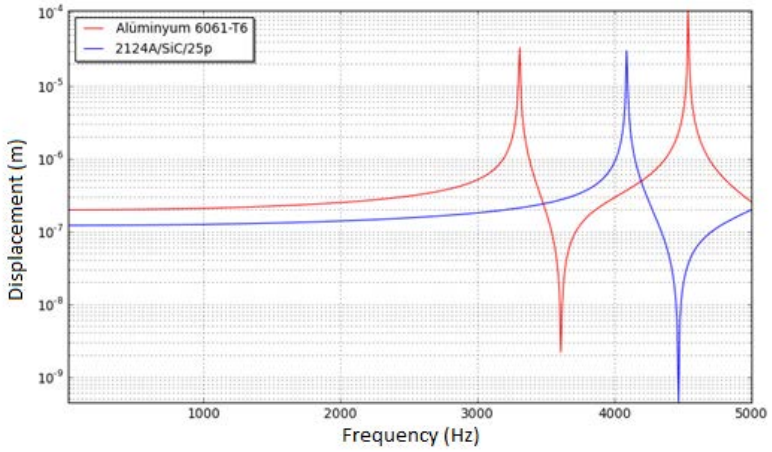

Fig. 3 Response of the plate against Point forced damped vibrations.

Figure 4 shows that when examined, there are two modes aluminum 6061-T6 plate because of applied frequencies range is 0-5000 Hz. But AA2124/SiC/25p material has only a natural frequency. Referring also to Figure 4, the displacements occurring in the material subjected to the same load the remaining two are different from each other. Displacement on MMK plate is considered to be less than aluminum plate.

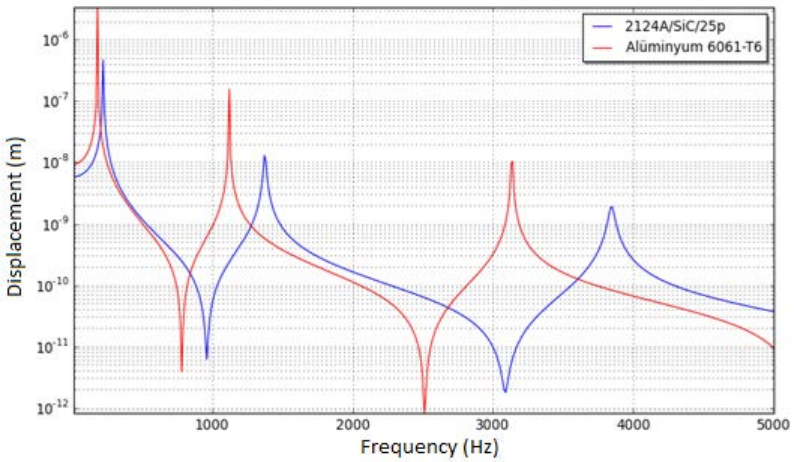

Fig. 4. Response of the plate against distributed forced damped vibrations.

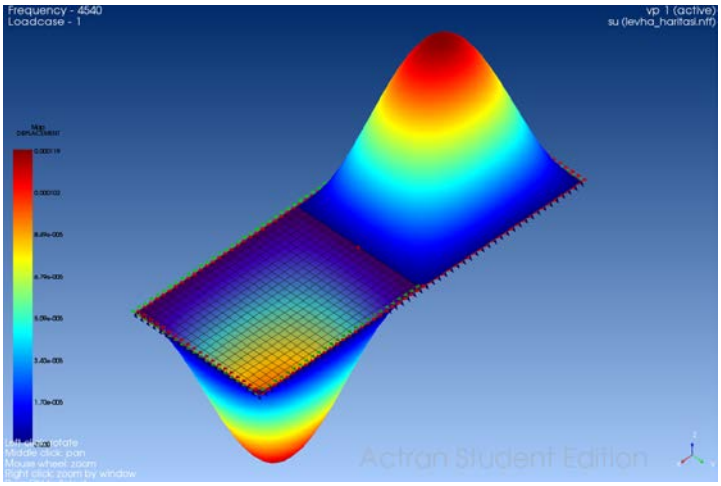

Fig. 5 Modal shape of aluminum 6061-T6 at 4540 Hz

Conclusion

In this study, AA2124/SiC/25p and aluminum 6061-T6 materials used in the aerospace industry have been compared to the vibration behavior. According to the analysis results, natural frequency value of AA2124/SiC/25p material is greater than the aluminum 6061-T6 materials. This shows us that this material is more resistant to dynamic loads. The aluminum 6061-T6 material has been shown to lower frequencies in change mode. Due to the properties owned by the AA2124/SiC/25p material is particularly important in terms of the aluminum 6061-T6 materials used in the aerospace industry.

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DEPOLLUTION OF OLIVE MILL WASTEWATER THROUGH ELECTROCOAGULATION AND ADVANCED OXIDATION

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Abstract: The goal of the Research described in this paper is to treat Olive Mill Wastewater (OMWW) to cause its decolorization, thus enabling its safe and legal release in main water streams. To this end, two different methods were tested on samples of OMWW collected from Ain Taoujdate, a small town that is located 25 km to the south of Fez, Morocco. These samples were freshly diluted by a factor of 20 prior to a treatment by either electrocoagulation or the photo-Fenton process, a type of advanced oxidation. It was found that an electrocoagulation treatment of two hours, at 22V DC with aluminum plates, was satisfactory to get nearly clear and colorless water (93% decolorization). A phenolic content reduction by 92.4% was obtained using this same technique. Photo-Fenton was tested with the use of H_2O_2/Fe(II), O_2/Fe(II), and H_2O_2/O_2/Fe(II) at a wavelength of 254 nm. With this technique, the best operating conditions afforded 78% decolorization. A discussion on the viability of each technique concludes this study.
Keywords: Wastewater, Pollution, Electrocoagulation, Oxidation, Fenton

Introduction

With an annual production of 140 000 tons of olive oil in 2014-2015, Morocco is ranked the 5th biggest producer of olive oil in the world. Unfortunately, like in nearly all industries, the production of this good is accompanied by the production of wastes that represent a major environmental issue and that must be dealt with. During the olive oil production process, two kinds of residues are generated: a wet solid waste called “crude olive cake” and an aqueous waste called “olive mill wastewater, OMWW”. OMWW is a dark liquid effluent characterized by high concentrations of organic compounds, including organic acids, sugars, tannins, pectins and phenolic substances that makes it phytotoxic and inhibit bacterial activity. In 2014, the amount of OMWW generated in Morocco alone was estimated to be 250-400 000 m^3 per year and given that 1 m^3 of OMWW is equivalent to 100-200 m^3 of domestic sewage(Morocco Department of Environment, 2014; Alami, 2014). OMWW treatment and disposal is a problem with great complexity due to the strong nature of the waste and also to several economical, technical, and organizational constraints involved in the olive oil sector (Tsagaraki et al., 2007). Over the last 60 years, practically all treatment processes developed for domestic and industrial wastewaters have been tested on OMWW but none of them appeared suitable to be generally adopted (Tsagaraki et al., 2007). These processes include aerobic processes (Cereti et al., 2004; Lanciotti et al. 2004) , anaerobic processes (Borja & Gonzalez, 1994; Dalis et al. , 1996; Zouari, 1998; Zouari & Ellouz, 1996; Azbar et al., 2004; Rozzi & Malpei, 1996), anaerobic digestion (Niaounakis & Halvadakis, 2004), pH neutralization (Mitrakas et al., 1996), coagulation (Niaounakis & Halvadakis, 2004), electro-coagulation (Khoufi et al., 2007) , advanced oxidation processes (Gernjak et al., 2004 ; Rivas et al, 2001; Ouardaoui, 1996; Ouardaoui et al., 1995; Ouardaoui et al., 1997), distillation/ evaporation (Rozzi & Malpei, 1996; Niaounakis, 2004) , and membrane processes (ultrafiltration, microfiltration, reverse osmosis (Yahiaoui et al., 2011; Petrotos et al., 2014 ; Coskun et al., 2013) . When not dumped illegally directly into nearby aquatic bodies, i.e. rivers, lakes, or even the sea (Galiatsatou et al., 2002) nearly all olive mills in Morocco, and around the globe at large, dispose of OMWW in evaporation ponds or storage lakes (lagoons), such as the one shown in Figure 1. This technique consists in storing the waste outdoor and let its water evaporate naturally in ambient air by exposure to sunlight.

Figure 1. OMWW evaporation pond beside an olive mill in Ain Taoujdate, Morocco (Feb. 2016).

In spite of having low energy costs and being simple to operate, this method has important drawbacks; it requires a long waste residence time (7-8 months) and a large land surface area (~1 m^2 for each 2.5m^3 of OMWW). Furthermore, it raises several ecological concerns including the possibility of groundwater contamination if the bottom of the pond is not properly lined against infiltration and leakage – as it is often the case – and the emissions of methane in the atmosphere due to the anaerobic fermentation of the waste that occurs in the pond (Tsagaraki et al., 2007; Azbar et al., 2004; Rozzi & Malpei , 1996). Finally, these ponds and lagoons cause serious nuisance to their neighborhood because they attract insects and cause foul smells.

Materials and Methods

Chemicals and Equipment

Sodium hydroxide was supplied by Fluka, Switzerland. Aluminum sulfate was supplied by AppliChem Panreac, Spain. Ferrous sulfate heptahydrate was supplied by Fluka, Switzerland. Oxalic acid monohydrate, 99% pure, was supplied by PanReac Applichem, Germany. Hydrogen peroxide, 110 vol., was supplied by Société Nouvelle Pharmac, Morocco. Ethanol, 96% pure, was supplied by Carlo Erbo, Spain. Anhydrous sodium carbonate was supplied by Sigma-Aldrich. The Folin-Ciocalteu reagent was supplied by Educomptoir, Morocco. Medical grade oxygen gas was supplied by Maghreb Oxygen, Morocco.

For centrifugation, a 5500 rpm centrifuge, *Hettich Zentrifugen* model EBA 30, was used. Vacuum filtrations were performed by means of piston-powered vacuum pump with a pressure of 0.85 atm and an air flow of 38 L/min. Weights were measured by an *AND* balance with a readability of 0.01g model EK610i, an *OHAUS* balance with a readability of 0.0001g model AS120, or a *KERN* balance with a readability of 0.05g model KB10K0.05N. pH and temperature were measured by using a *Hanna* instruments pH meter model HI 9318.

Preparation of solutions for phenolic content determination was done by means of 25 µL and 100µL syringes, supplied by *HAMILTON*, Switzerland. For heating and stirring, digital stirring hotplates were used. Either *DLab* MS-H280-pro or *VWR* VMS-C7 advanced series. For electrocoagulation, a *Tektronix* voltage meter model PS280 was used. For measuring the absorbance, a *Jenway* spectrophotometer model 6320D was used. Wavelength scan was done with a *JASCO* spectrophotometer model V-530. Conductivity was measured with a *YSI* conductivity meter model 33. Ultraviolet light was generated by a *CAMAG* UV transilluminator model CM3 with wavelengths of 254 nm and 366 nm, and a *FOTODYNE* UV transilluminator model C3-3501. A Q.10 *CHANDOS* quartz cuvette was used to perform photo-Fenton reactions.

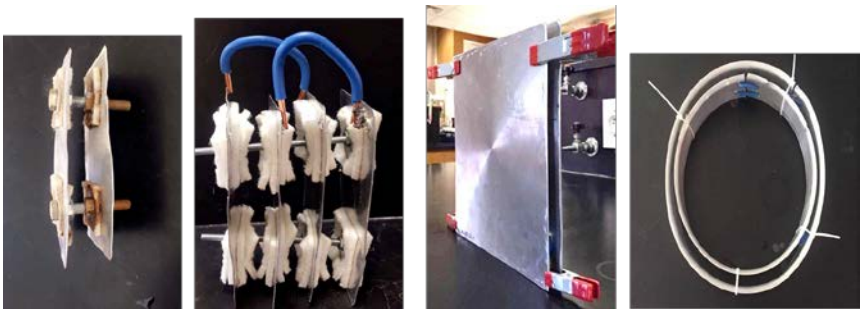
Phenolic content determination

The determination of total phenolics in treated OMWW samples was based on a micro method reported in the literature (Waterhouse, 2012). It was performed by spectrophotometry with gallic acid as standard. A calibration curve was plotted by preparing six standards. The latter were made in 4-mL glass vials by mixing 20 µL of gallic acid solution being in the concentration range 0-50-100-150-250-500 mg/L, 1.58 mL of distilled water and 100 µL of Folin-Ciocalteu reagent. After vigorous shaking for 1 min at room temperature, 300 µL of aqueous saturated sodium carbonate solution was added. Next, the solution was shaken again and heated at 40°C for 30 min by means of a bain-marie. The resulting blue solution was transferred entirely into the cuvette of a spectrophotometer and absorbance was measured at a wavelength of 765 nm. A 5000 mg/L aqueous gallic acid stock solution was used to prepare these solutions accurately.

Electrocoagulation experiments

All OMWW samples that were treated by electrocoagulation were first diluted with distilled water by a factor of 20. Next, they were filtered, centrifuged for five minutes at 5500 rpm, and re-filtered in order to measure their absorbance at a wavelength of 395 nm. The applied voltage for all electrocoagulation experiments was 22 V DC unless stated otherwise. Filtrations were done under vacuum over cotton wool.

Four different aluminum cells with various sizes and geometries were constructed and tested in the laboratory (Figure 1).



Cell #1 **Cell #2** **Cell #3** **Cell #4**

Figure 1. Aluminum cells tested in the electrocoagulation experiments.

Characteristics of these cells are given in Table 1.

Table 1. Aluminum cells tested in the electrocoagulation experiments.

Cell name	***Shape***	***Number of plates***	***Effective surface area (cm^2)***
Cell #1	rectangular	2	139
Cell #2	rectangular	4	256
Cell #3	square	2	783
Cell #4	round	2	2791

Photo-Fenton experiments

Since photo-Fenton experiments require an exposure to UV light (λ= 254 nm), they were conducted directly in the quartz cuvette of a spectrophotometer having a thickness of 1.0 cm. When performed on a larger scale, experiments were conducted in a 50mL glass beaker placed below a UV lamp. The source of Fe (II) chosen for our experiments is iron (II) oxalate, FeC_2O_4. This compound was made by mixing equal volumes of aqueous solutions of 30 mM iron (II) sulfate, $FeSO_4$ and 5 mM oxalic acid, $C_2H_2O_4$. The photo-Fenton experiment consisted in reacting within a cuvette, 0.5 mL of iron (II) oxalate solution, FeC_2O_4, 1 mL of 8mM hydrogen peroxide solution, H_2O_2, and 1.5mL of OMWW sample. When need be, a gas tubing was inserted in the reacting mixture to allowing bubbling of oxygen gas with a controlled flow rate.

Results and Discussion

Conventional coagulation

Our first attempts to treat OMWW were done by performing conventional coagulation experiments by using two coagulants known to be effective in the field of wastewater treatment: iron (II) sulfate, $FeSO_4$, and aluminum sulfate, $Al_2(SO_4)_3$. In spite of a treatment time as long as 24 h and the testing of different pH conditions, none of our attempts with conventional coagulation was successful. Therefore, in our hands this technique, and these two simple coagulants, did not seem suitable for an effluent as complex as OMWW.

Electrocoagulation

Electrocoagulation differs from conventional coagulation mainly with the fact the coagulant – in our case aluminum hydroxide – is generated in situ. This technique turned out to be very successful when applied on OMWW. Figure 2 shows the evolution of a sample of OMWW being treated for 19 h with cell#2.

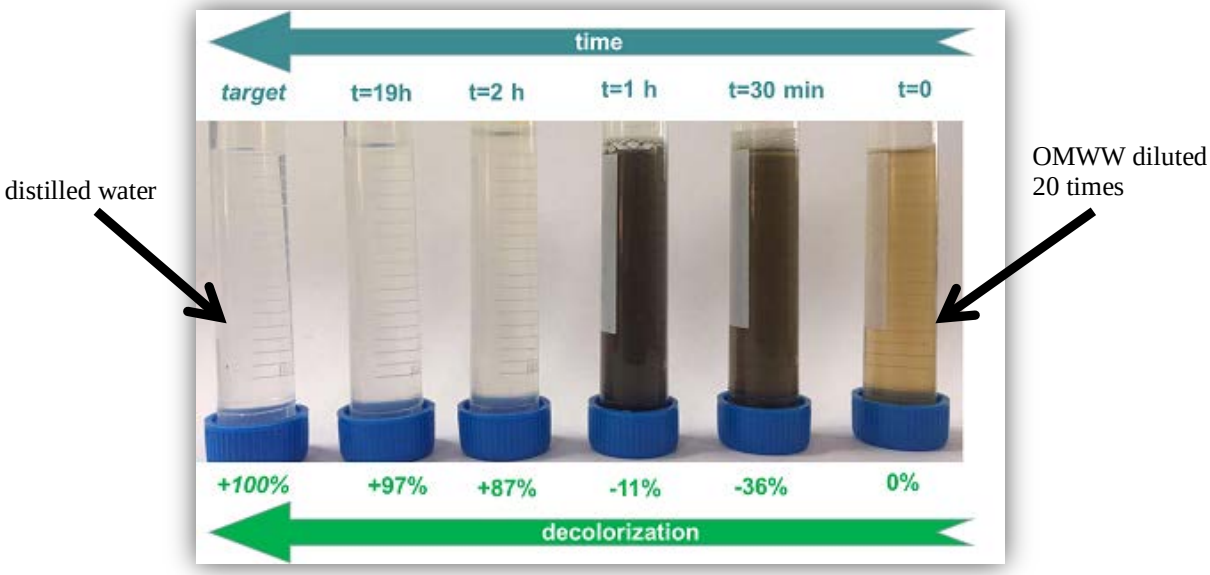


Figure 2. OMWW sample being treated by electrocoagulation with cell #2.

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As shown in Figure 2, the OMWW gets initially darker and darker in the initial stage of the treatment. This phenomenon is presumably caused by the absence of a critical mass of coagulant at the outset. However, once the treatment has been carried out long enough, a high decolorization of the sample is attained (+87% in 2 h). Decolorization starts taking place when flocs are formed and precipitated; however, their particle surface charge are affected by various parameters, one of which is the pH of the solution. Evidence for this explanation was obtained by monitoring the pH and the absorbance simultaneously (Figure 3). Indeed, Figure 3 shows that after 60 min of treatment, the increase of pH causes an immediate drop of the absorbance and therefore a decolorization. This increase in pH, which is typical in electrocoagulation, is caused by the formation of hydroxide ions at the cathode.

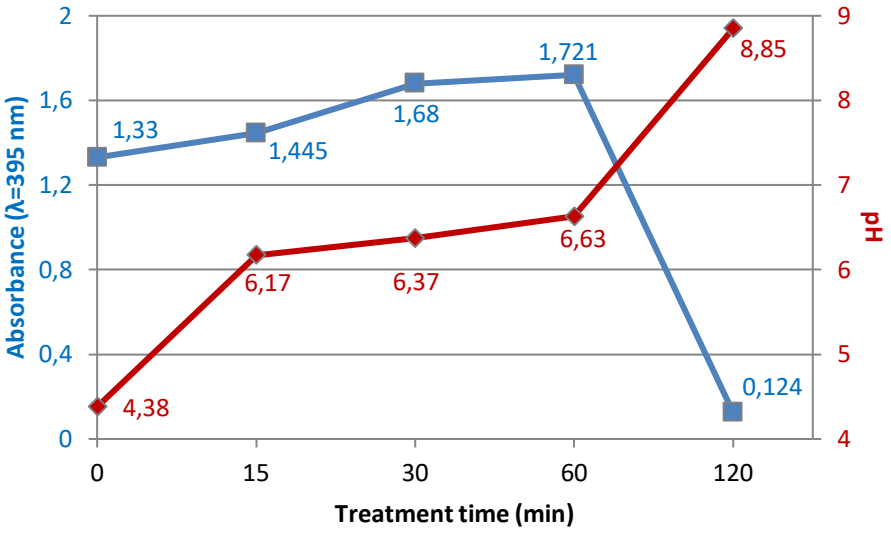

Figure 3. Monitoring of absorbance and pH in the electrocoagulation of OMWW with cell #2.

The effect of pH on decolorization is due to the solubility of the different aluminum hydroxide species in different pH ranges (Holt et al., 2005) Indeed, depending on the pH, aluminum hydroxide will exist either as a monomeric species (e.g $Al(OH)^{2+}$, $Al(OH)_2^{+}$, $Al(OH)_4^{-}$), a polymeric species (e.g. $Al_2(OH)_2^{4+}$, $Al_2(OH)_2^{5+}$) or an amorphous and less stable species (e.g. $Al(OH)_3$)(Bensadok,et al., 2008)

Table 2 compares the results obtained with each of the cells employed in our electrocoagulation experiments.

Table 2. Results obtained with cells 1-4 in the electrocoagulation experiments

Entry	Cell name	Conditions				Results		
		Volume of OMWW treated (L)	Voltage applied (V)	EC[(a)] treatment time (h)	Settling time (days)	Decolorization[(b)]	pH	Conductivity (μS/cm)
1	Cell #1	0.475	22	2.5	0	+84.0%	6.22	690
2	Cell #2	0.790	22	2	2	+ 92.3%	6.13	510
3				19	2	+ 97.4%	-[(c)]	300
4	Cell #3	9	14	15.5	10	+ 93.5%	7.41	550
5	Cell #4	5	11-13	8	10	+ 93.2%	7.65	550

(a) EC: electrocoagulation.
(b) Based on the change of absorbance at λ=395 nm. Sample centrifuged for 5 min beforehand.
(c) Not determined.

Determination of the phenolic content reduction was done for OMWW treated with cell #3. The concentration of polyphenols, expressed as mg of gallic acid equivalent, was found to drop by 92.4%; an excellent result given the detrimental effect of these polyphenols to the environment.

Photo-Fenton

Results obtained in the treatment of OMWW with the Fenton and photo-Fenton process are shown in Table 3.

Table 3: Results obtained in the Fenton and photo-Fenton experiments. [Fe^{2+}]initial = 3 mM].

Entry	UV light[(a)]	O_2 (g)[(b)]	[H_2O_2]	Treatment time	Type of OMWW treated[(c)]	Decolorization[(d)]
1	no	no	5 mM	20h	Untreated	+8.0%
2					Pre-treated by EC	+2.1%
3	no	no	8 mM	20h	Untreated	-3.9%
4					Pre-treated by EC	**+15.6%**
5	yes	no	8 mM	2h	Untreated	-21.3%
6					Pre-treated by EC	-29.1%
7	yes	no	5 mM	5h	Untreated	+4.1%
8					Pre-treated by EC	-13.5%
9	yes	no	5 mM	5h	Untreated	+9.6%
10				+ 15h settling	Pre-treated by EC	-6.8%
11	yes	yes	0 mM	2h + 15h settling	Pre-treated by EC	-10.9%
12	yes	yes	8 mM	2h	Pre-treated by EC	-17.5%
13				2h + 3 days settling	Pre-treated by EC	**+78.2%**

(a) λ=254 nm.
(b) Flow rate: 40 mL/min.
(c) Untreated = only diluted with distilled water by a factor of 20. EC = electrocoagulation.
(d) Based on the change of absorbance at λ=395 nm. Sample centrifuged for 5 min beforehand.

First, **entries 1-4** show the level of decolorization attained in the Fenton process (i.e. absence of UV light). Under the conditions tested, the best result was obtained in the treatment of OMWW pre-treated by electrocoagulation for 20h with 8mM H_2O_2 and 3mM Fe (II), to afford a color reduction by 15.6%. In the case of untreated OMWW, it was found that a lower concentration of H_2O_2 is favorable to a rapid degradation of organic pollutants (**entry 1** vs **entry 3**); however, the opposite trend is observed when dealing with OMWW pre-treated by electrocoagulation (**entry 2** vs **entry 4**). Therefore, our data seems to indicate that the efficiency of the Fenton process can be fairly variable since it can be affected by both the oxidant concentration and the quality of the effluent to be treated. **Entries 5-13** deal with the photo-Fenton process (i.e. UV-induced degradation). Comparison of **entries 5,7,9** vs **entries 6,8,10** shows that better results are obtained by processing untreated OMWW rather than the pre-treated one. It was found that an increase of the treatment time from 2h to 5h, in spite of a reduction of the oxidant

concentration from 8mM to 5mM, leads to a higher level of decolorization (**entry 5** vs **entry 7**). Also, our data shows that settling of the solution over a prolonged period of time is also beneficial to the purification process when used post-treatment (**entry 7** vs **entry 9**). When oxygen gas, O_2, was used either as a replacement of H_2O_2 or as a co-oxidant (**entries 11-12**), poor results were obtained. However, with proper reaction conditions of time and oxidant concentration, the combination of O_2 and H_2O_2 as oxidants afforded an exceptionally high level of decolorization (+78.2%, **entry 13**).

Conclusion

A total of four techniques were tested in our investigation, namely coagulation, electrocoagulation, Fenton, and photo-Fenton. One the one hand, coagulation and Fenton performed poorly in terms of decolorization of OMWW. On the other hand, electrocoagulation and photo-Fenton in presence of oxygen gas both proved to be potent and efficient solutions when performed under the right experimental conditions of time and oxidant concentration. Though electrocoagulation affords the best results in terms of decolorization (>93%) and phenolic content reduction (>92%) at the scale of the laboratory, its utilization at the olive mill scale may be challenging because of the inherent high energy cost of the technique. Consequently, the future of this technique will be largely dependent on its optimization by for example powering it with inexpensive energy sources. Regarding the photo-Fenton process, the identification of unique experimental conditions enabled to reach a decolorization of pre-treated OMWW by more than 78%. This technique is attractive because of its practicality; however, its use at a large scale may be hampered by the cost of usage and maintenance of UV light. This study has clearly shown that the issue of OMWW treatment can be hardly solved by a single method, but that it rather relies on the clever combination of a sequence of finely tuned processes to be operated individually. Electrocoagulation and photo-Fenton have been proved to be very good examples of such processes.

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DESIGN, MANUFACTURING AND EXPERIMENTAL INVESTIGATION OF ORGANIC RANKINE CYCLE APPARATUS

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Abstract: Turkey has a variety of heat sources between 90 and 125 ˚C which are not suitable for power generation. These sources are waste sources or used only for heating purposes. Whereas these sources can be used to produce electricity with Organic Rankin Cycle (ORC) so that economic recovery may be obtained. Because of technical difficulties and non-economic situation to utilize low temperature heat traditionally constitutes challenging. Traditionally, steam turbine is used in power generation. But it requires high temperature and pressure for proper operation. Preferred technology at low temperatures is the Organic Rankin Cycle (ORC). The ORC technology uses liquids which boils at lower temperatures than water, less risk of corrosion and high molecular weight instead of high pressure water and steam. In this study, low-temperature waste heat source ORC system is designed, produced and used in power generation. Experimental studies were performed using R134a and R22 refrigerant in the produced system. At the end of the experimental studies, the performance of the system were determined.
Keywords: Energy analysis, ORC, Power Production, Waste Heat

Introduction

Demand for energy increases due to technological developments and population rise every passing day. Today, energy is considered to be a criterion of development in all countries. As Turkey is just at the threshold of development, its energy need increases every passing day. However, although it has a great variety of energy sources, its current sources cannot meet its energy need for consumption. Incapability to use domestic sources in energy generation shows Turkey's external dependence. External dependence in energy increases every passing year. Hence, a big move has to be made in energy generation through domestic sources. If such move is not made, such external dependence is likely to rise to above 80s% in the forthcoming periods. Therefore, Turkey has to make use of its energy sources in the most economical and efficient way and utilize alternative energy sources (Türkyılmaz, 2014). In this regard, organic Rankine cycle (ORC) appears as a strong alternative. Although ORC technology has a long past, it is a new energy generation method for Turkey. Today, there are ongoing new studies aimed at generating stronger energy and providing more efficient working conditions in ORC systems. In general, ORC systems are designed and used based on waste heat, geothermal energy, and solar energy (Ergün, Özkaymak & Kılıçaslan, 2016; Ergün 2014). Agahi et al. (2011) conducted a study about optimal air-cooled condenser sizing in geothermal ORC (binary) systems. They proposed a new methodology for an air-cooled condenser optimization and used a registered simulation software to evaluate the performance of the geothermal power plant by changing the condenser design parameters. Based on the data obtained from the simulation, they determined the economical factors and the optimal design parameters of the air-cooled condenser. Yılmaz et al. (2015) made energy and exergy analyses by examining a solar ORC system run by R-410a organic fluid according to the solar power data of Isparta province. They determined the thermal efficiency and exergy efficiency of the system to be 10% and 70% respectively and stated that rise in turbine inlet pressure and boiler pressure increased the thermal efficiency and exergy efficiency. Özden and Paul (2011) examined Denizli, Sarayköy geothermal power plant where electricity is generated through ORC technology and provided information about selection of the working fluid, installation of the system, and advantages of the ORC system. Etemoğlu et al. (2006) analyzed the usability of geothermal energy in Bursa province and its surrounding and used and explored ORC technology in a geothermal source with the inlet conditions of 161 kPa and 102.2 ˚C. In the system in which isopentane was used as a working fluid, the biggest irreversibility was found to be in the vaporizer (43%). Eyidoğan et al. (2016) made the technical and economic analyses of ORC systems in Turkey and indicated the areas of application in detail. In their study in which they gave information about the incentive programs of the government, they made the feasibility analyses of a biomass-supported 1MW ORC power plant as an example and found the payback period to be approximately 2.7 years. Kavasoğlu and Cihan (2015) made the energy and exergy analyses of a conventional refrigeration cycle run by an ORC system using waste hot water as heat source. They used R123, R600, R245fa, R141b, and R600a fluids in the system and investigated the exergy efficiency, performance coefficient, and exergy destruction values of the system and found R141b to be the most appropriate fluid. Zheng et al. (2015) used one-kilowatt rotating type piston expander and the R245fa working fluid to explore the dynamic testing of the expander. They established an experimental system and used a hot water boiler as a source at low temperature. They explored and analyzed experimental results such as the mass flow of the fluid, expander inlet-outlet temperature and pressure, the obtained power, and rotational speed. At the end of the experimental study, they found out that the expander worked in the range of 350-800 rpm and had a maximum output power of 0.35 kW at 90°C source temperature.

Based on such information, they calculated the maximum expander isentropic efficiency to be 43.3% and ORC efficiency to be 5%. Eyidoğan et al. (2015) made the energy and exergy analyses of a biomass-based ORC system obtained from forestry products. They used real system data and employed biomass-based hot oil boiler as the source temperature of the ORC unit. They made energy and exergy analyses on the evaporator, condenser, and turbine, which are the main equipment of the ORC system, under two different working conditions. They also investigated the effects of the condenser pressure on energy and exergy efficiency. Under the first working condition, they found energy efficiency to be 12.57% and exergy efficiency to be 33.26%. Under the second working condition, they found energy efficiency to be 13.2% and exergy efficiency to be 35.5%. The distribution of exergy destruction in the system equipment in a descending order was found to be as follows: evaporator, condenser, turbine, regenerator, and pump. Dai et al. (2009) examined a waste-heat recovery ORC system by using different working fluids. They analyzed the effects of thermodynamic parameters on ORC performance and optimized thee parameters for each fluid. Quoilin et al. (2011) carried out the thermodynamic and thermoeconomic optimization of small-size water-heat recovery ORC system. They examined the cycle performances determined through R245fa, R113, n-butane, n-pentane, and R1234yf organic fluids and different equipment sizes. For n-butane fluid, they determined a specific cost of 2136 €/kW, a net output power of 4.2 kW, and a system efficiency value of 4.47% for thermoeconomic optimization. Thermodynamically, they determined the system efficiency to be 5.22% for the same fluid. Al-Sulaiman et al. (2013a,b) conducted a two-part study. In the first one, they provided equations and calculations related to the thermodynamic optimization of a fuel cell, biomass, and solar power trigeneration system integrated with three new ORCs. In the second part, they made the calculations of three new systems whose equations they showed. In the end, they found the highest trigeneration exergy efficiency to be 38% in the fuel cell ORC system. It was followed by the biomass system (28%) and the solar power system (18%).

In the present study, power was generated by designing and manufacturing an ORC system based on low temperature waste heat working according to the organic Rankine cycle principle. In addition, experiments were carried out in this ORC system by using the R-134a and R-22 working fluids, thereby making the performance and efficiency analyses of the system.

Materials and Methods

ORC systems are the systems which have quite a similar working to the known Rankine cycle, but use the organic fluids passing to the vapor phase at lower temperatures instead of working fluid. The layout of a simple ORC system is seen in the Figure 1 below.

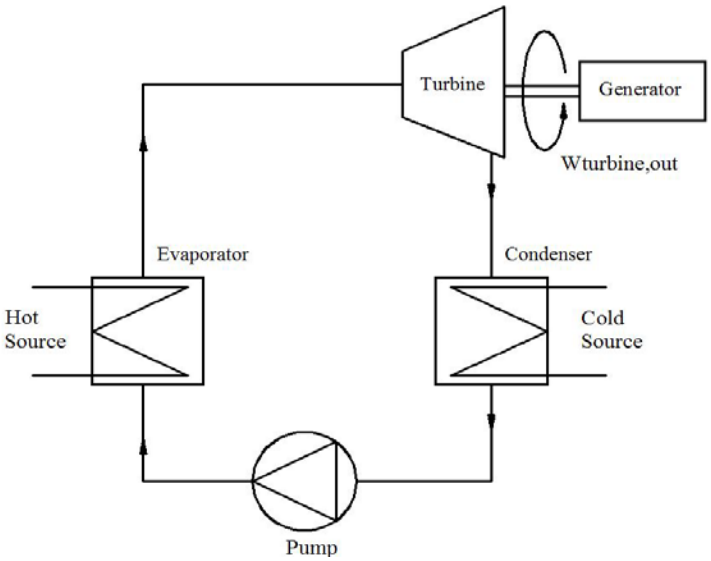

Figure 1. Organic Rankine cycle (ORC) layout

As is known, a fossil-origin fuel is burnt, thereby turning the fluid into superheated vapor in Rankine cycle. In the ORC system, on the other hand, superheated vapor is obtained at lower temperatures without burning any fuel with an external heat source. The fluid pressurized with the pump is converted into mechanical work in the turbine. It turns into the liquid phase in the condenser. The cycle of the system goes on in this way.

In this study, a system working according to the organic Rankine cycle principle was defined and manufactured. The designed and manufactured system is showed in the Figure 2 below in detail.

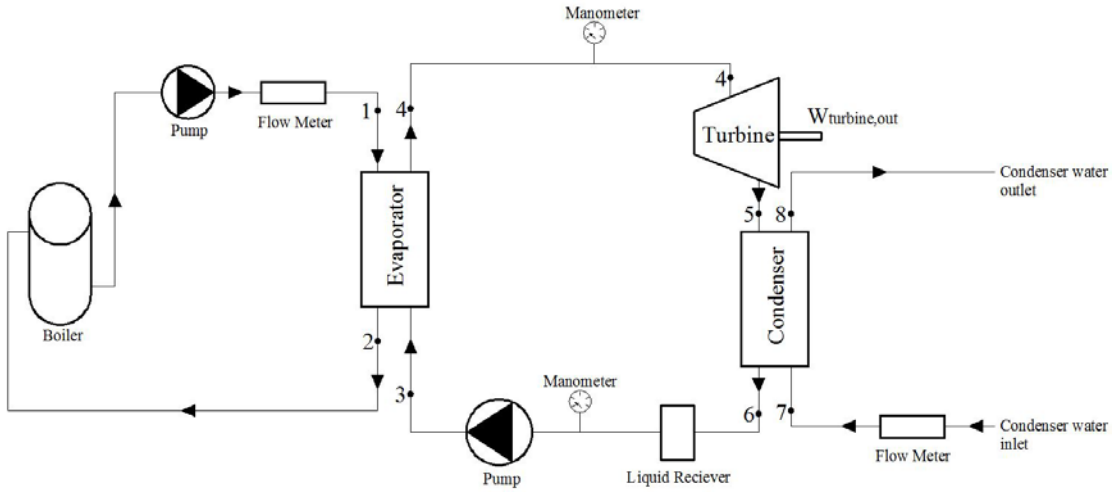

Figure 2. The Designed and Manufactured System

In the system, two plate heat exchangers (to be used as evaporator and condenser), Sanden scroll compressor (as turbine), and a magnetic pump (for the circulation of the organic fluid) were used. In addition, a 15-liter capacity boiler was designed as the heat source (evaporator) of the system. It was manufactured in a way allowing control via thermostat. A 50 W pump was used for the circulation of the boiler water. City water was connected to the heat exchanger for the cold source of the system (condenser). Evaporator and condenser water flows were determined via float type flow meters. In the system, pressure values were checked via manometers while temperature values were checked via Picolog data logger.

Thermodynamic Analysis of the System

The organic fluent flow in the system can be determined by writing energy equation for the heat exchanger used as an evaporator.

$$Q_{su} = Q_{oa} \quad (1)$$

$$m_{water} \times c_{p_{water}} \times \Delta T_{water} = m_{oa} \times c_{p_{oa}} \times \Delta T_{oa} \quad (2)$$

The energy entering the system is equal to the difference between the enthalpy in the entrance of the hot water obtained in the boiler and the enthalpy in its exit multiplied by mass flow. It is expressed with the Equation 3.

$$Q_{entering} = m_{hot,water} \times (h_1 - h_2) \quad (3)$$

The mechanical work obtained from the system is equal to turbine work. It is showed in the Equation 4 below.

$$W_{turbine} = m_{oa} \times (h_4 - h_5) \quad (4)$$

The network obtained from the system (Wnet) is calculated by subtracting the pump powers from the power obtained in the turbine. The powers of the pumps used in the system were taken as 300 and 50 Watt from the catalog. This values shows the net power to be used while calculating the energy efficiencies. It is calculated with the Equation 5.

$$W_{net} = W_{turbine} - W_{pump} \quad (5)$$

The thermal efficiency of the system is calculated through the Equation 6.

$$\eta_{Termal} = \frac{W_{net}}{Q_{entering}} \quad (6)$$

Results and Discussion

In the present study, data were obtained by carrying out five experiments for each one of the R134a and R22 fluids at the intervals of 10 minutes. The data obtained through the equations given above are presented in graphs.

The mass flows calculated by using the Equation (2) based on the values measured during the 50-minute experiment are graphically showed for both fluids in the Figure 3.

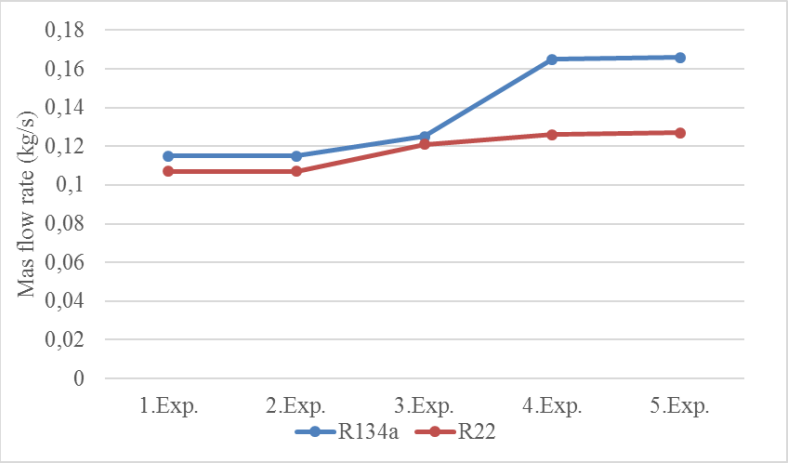

Figure 3. The flow values of the R134a and R22 fluids

Figure 4 and Figure 5 show the change in net work changing depending on the source temperature and turbine inlet temperature in the system for the R134a gas. As is seen in the figure also, as source temperature and turbine inlet temperature rise, the net work produced increases as well.

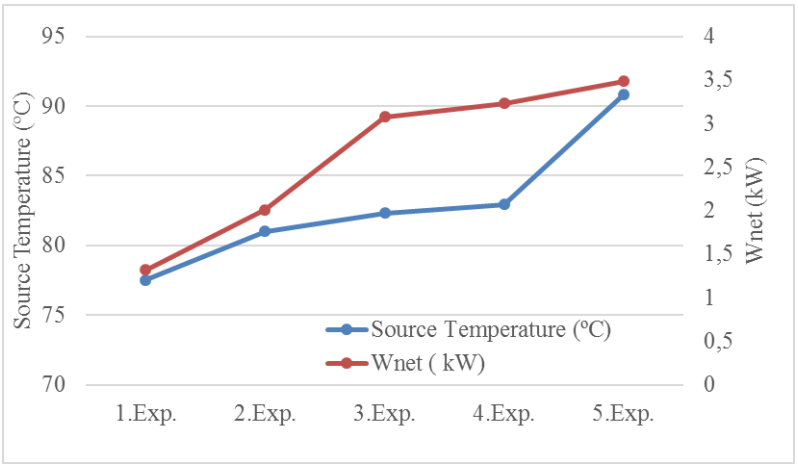

Figure 4. The net work produced based on the source temperature

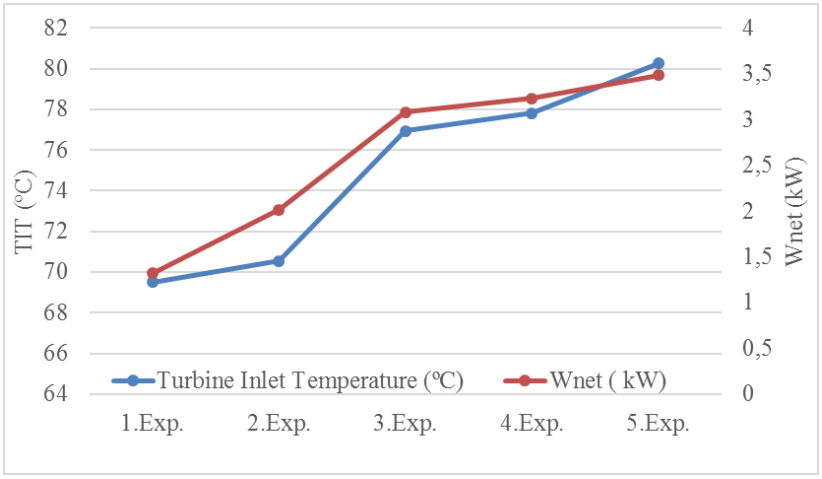

Figure 5. The net energy values produced by the R134a fluid based on the turbine inlet temperature

Figs. 6 and 7 show the change in net work based on the source temperature and turbine inlet temperature for the R22 gas. In a similar way to the R134a fluid, net work increased as the source temperature and turbine inlet temperature rise.

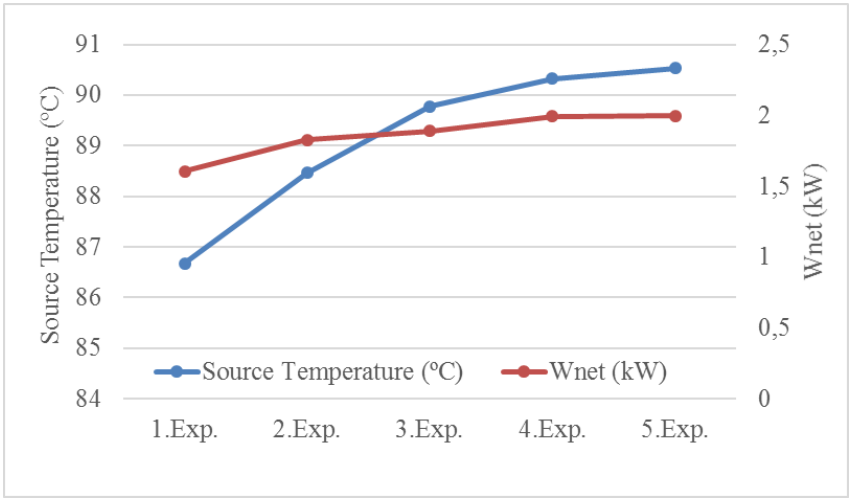

Figure 6. The energy values produced by the R22 fluid based on the source temperature

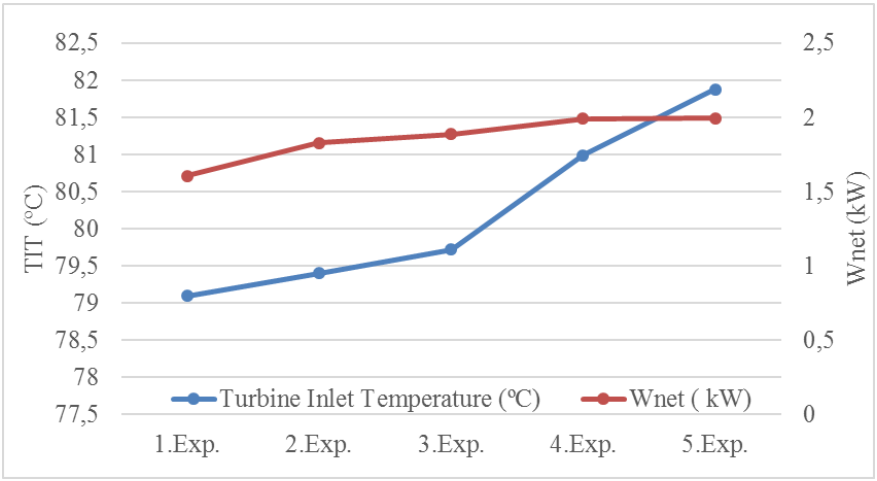

Figure 7. The energy values produced by the R22 fluid based on the turbine inlet temperature

Figs 8 and 9 provide efficiency and net work comparisons for the two fluids. The net work and efficiencies are higher for R134a fluid.

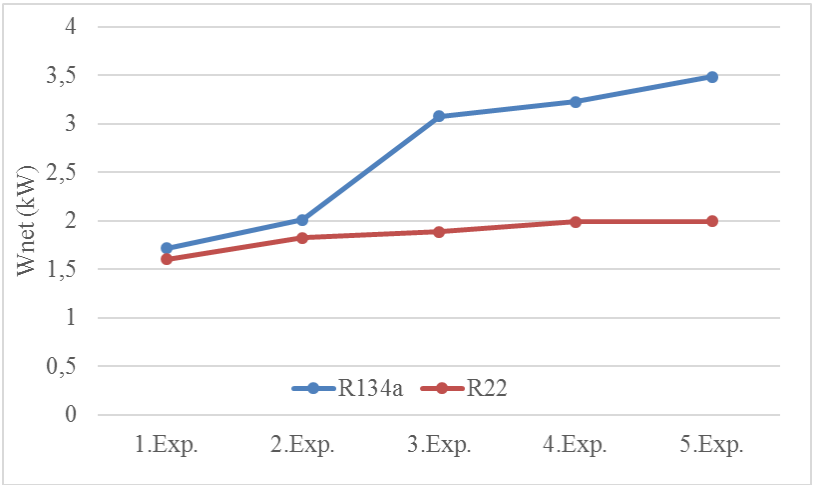

Figure 8. Comparison of the network generated by the R134a and R22 fluids through the turbine

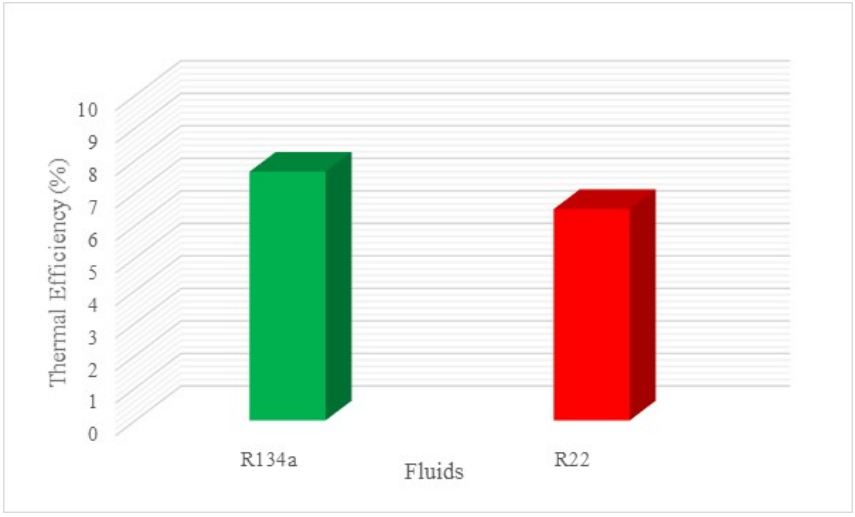

Figure 9. Comparison of the efficiencies

Conclusion

In the present study, the following findings were obtained based on the experimental data:

- Especially waste-heat recovery and geothermal systems working according to the organic Rankine cycle principle are suitable for continuous electricity production. The use of these sources stands as an alternative solution that can reduce Turkey's external dependence in energy.
- Source temperature is very important in ORC systems. The higher the source temperature is, the higher net work and efficiency are.
- Besides the source temperature, the turbine inlet temperature of the organic fluid is one of the most critical parameters. Transferring the source temperature to the organic fluid with minimum loss possible will enhance the efficiency of the system. Hence, the design of the heat exchanger used as evaporator is of great importance.
- The R134 gas used in the system provided more efficient working conditions. The main criterion in these kinds of power generation plants is the net power generated. It is reported in the literature that calculating exergy efficiency rather than thermal efficiency yields more accurate results in the comparison of ORC systems. Therefore, it is recommended to make exergy analysis of these systems besides their thermal analysis.

Acknowledgements

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DEVELOPING MICROGRID CRITERIAS AND PROPER DATA PACKAGE FOR CENTRALIZED MANAGEMENT OF MULTI MICROGRIDS

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Abstract: In this study, Microgrid (MG) Characteristics are defined for perform an effective and fair management of multi microgrids system. A research study has been conducted in order to establish data package for description of MGs. Criteria of MG characteristics for determining an approach not only protects the interests of the energy grid, both the interests of energy grid and microgrid are mutually used an approach that protects. In this paper, the justification of selected criteria discussed and the data package for these criteria were analyzed how much data length is needed in data package. Also the appropriateness of the communication technology of the generated sample data package is examined. The work is expected to be made an important contribution to the creation of microgrid standards.

Keywords: Microgrid, fair-management, microgrid-characteristics, multi-microgrid.

Introduction

Microgrid (MG) concept was first proposed in 2002 and the concept is that the charges are a set and micro sources provide electric and heat to the system. This concept arises from the need of the integration of many micro sources to the main energy grid (Lasseter R. H., (2002)) .Since 2002, renewable energy sources can be achieved through optimal adaptation to the energy grid by MG concept has now become a widely accepted idea (Lasseter R. H., (2011), Guerrero J.M. (2010)) .Worldwide growth of MGs also support this idea. For example, the increase in small and medium-sized MGs was a rate of 267% in the last five years according to information from the United States. However, this increase is not controlled by certain centers of MGs also brought up the fact that they should (Tsikalakis A.G. (2011), Lasseter R.H., Akhil A. (2002)).

If it is providing fast and reliable communication infrastructure, a large number of MGs when checking in specific locations, is expected to contribute to the solution of many important problems. For example, the most frequently encountered problem within the scope of the adaption of MG and the renewable energy sources to the interconnected system is the problems related to the change of the current direction. These problems have a negative influence on system protection structure and energy quality (Long M. (2016)). Communication is very important for the MG to run steady and stability after the integration of power and communication of MGs and the communication protocol has a massive role for handling the control latency that may occur during the transition from island mode and connected mode (Mao R. (2013)).

Generally, within the scope of MG, there are several studies about communication infrastructure, control optimization algorithms, protection, energy management, micro source management and autonomous control of MG components (Nthontho M. P. (2012), Gallina M. (2012), Shukla S. (2014), Siow L. K. (2011), Weimer J. (2012)). Also Intelligent Distributed Autonomous Power Systems (IDAPS) was examined in detail which it aims at intelligently managing customer-owned distributed energy resources such that these assets can be shared in an autonomous grid both during normal and outage operations (Rahman S. (2007)). In addition to these studies, controlling MGs and monitoring their status from a center is required to reach the goals of MGs such as reliability and continuous and good quality electricity flow. With the increase of renewable energy sources will be needed in this case the control centers and fair and efficient energy purchase / sale is necessary to standardize the information to be able to microgrid. The information to be sent and the command should be determined by what is MG status. In this study, the display of MG status and controlled from a center that allows for the creation of a data package according to MG information and gives detailed information about this data package.

What is the criterion for generally MGs, these criteria may be used in accordance with proper justification and communication technology is necessary to prepare the data package. These criteria are generally a MG's the characteristic denotes type and working values. Efficient use of a communication network for the specified degree of importance also in defining each criterion and is aimed to accelerate the data transmission. Smart grids under the MGs energy exchanges / markets after the creation of the distribution companies or smart grids will make bilateral agreements with the center (protocols) are also considered to be added to the reserved area in the data package. Fair benefits can be obtained as result of the study of energy trading, high energy quality; the aim

is to prepare the ground transition to reduce the risk of collapse and smart grid network. Also these data package correspond to a resilient flexible management system is aimed to improve the data package which different systems for example IDAPS or another systems.

The subject was examined in three sections. The second section is determined by the description of Microgrid Characteristics. In the third the necessary information and a data package samples are presented. In the fourth section of communication system architecture for monitoring MGs are assumed.

Description of Microgrid Characteristics

In this section, first of all which criteria for microgrid will be used for MG characteristics in multi MG system and what has been determined that the justification for these criteria. In generally these criteria:

- Special adress for MG,
- Generation type (photovoltaic, wind, natural gas etc.) and generation power,
- Whether with an energy storage system, storage type and how much power storage energy,
- Ability to run island mode, energy demand (buying / selling) and the amount of demand,
- Load characteristics and priority load metrics (hospital, school etc.)

information is what is designated as such. Also,

- Special protocols with MG and smart grid system,
- Whether with advanced metering infrastructure (AMI) system,
- Failure and maintenance information

This information should be added to the MG data package as private data. These criteria and the criteria as justification and availability frequency of the messages to be sent:

A. Address

This information is defined to integrate MG to the system. The data package has been sent to the Microgrid Management System (MGMS) which comes from the MG. This information is high-frequency coefficients of the criteria should be available in all messages.

B. Time Stamp

It represents the time of the generated data package. This information is high-frequency coefficients of these criteria and it is very important due to the control of MG time criteria should be available in all messages.

C. Energy Conversion Method

MG has several types of renewable energy sources which are photovoltaic, wind, natural gas, and cogeneration and so on. General characteristics of the types of these energy sources have production, stability, quality, in addition to electricity generation, heating other factors in the slightly improve and production conditions (weather, petrol / gas stocks, etc.) must be passed this information since it depends. Due to the change of frequency coefficients can't be sustained these criteria is low and is expected to be sent once a day.

D. Generation Power

This information refers to how much energy produce in MG. The amount of the generation and should be sent this information to determine how much energy could be given to the system. This high-frequency coefficient of the criteria should be available in all messages.

E. Storage Type

Small-scale energy storage systems use pad-mounted energy storage units distributed along residential feeders at the edge of the power grid. It refers to the type of storage system have different properties which are lead-acid, lithium ion, electrical vehicles and so on. These battery-based units permit the integration of the community's

intermittent renewable generation resources ¾ such as rooftop photovoltaic panels and wind turbines ¾ into the grid, where these increasingly popular resources can be dispatched when needed.

These parts have different life of the storage system, how much time due to the presence of factors such as the effect of type and generation power to provide energy to the system must be delivered to these criteria. The battery-based energy storage units can be aggregated to collectively provide peak shaving, improve power quality, and/or improve local voltage control to reduce losses and thus improve distribution feeder efficiencies. This aggregation of energy storage units can eliminate the need for costly, time-consuming infrastructure build-outs. Due to the change of frequency coefficients can't be sustained these criteria is low and is expected to be sent once a day (Zeng A. (2015), (Palızban O. (2016)).

F. Storage Capacity

This information refers the instant that represents how many kilowatts storage of MG and when and how to have the stored energy should be used in determining how many of the necessary energy is required for this information. Distributed energy storage can be a means for peak shaving since it doesn't require customer involvement. The mesh communication system used to link the energy storage units can help the utility quickly find the site of a problem on the distribution system without first dispatching a crew to locate it.

The energy storage units offer reliable, local backup power for consumers as well. The close proximity of the energy storage units to consumers helps ensure the availability of supplemental power in the event of an outage. A typical 25-kVA energy storage unit can offer supplemental power to several homes for up to three hours more than sufficient for the duration of many outages. They can also be deployed at traffic signals and used for emergency lighting, emergency communications, and more.

A fleet of larger-capacity energy storage units ¾ typically rated 250 kVA ¾ distributed throughout the grid can support hundreds of homes, small businesses, and critical infrastructure during an outage. When combined with the community's renewable generation resources, the resultant microgrid is capable of operating for many hours or even days. Groups of these larger-capacity energy storage units can be arranged as "virtual power plants" and suitably planned to be storm-ready in anticipation of an outage. With the deployment of virtual power plants, utility crews can concentrate on service restoration elsewhere on the system.

The distribution grid, transformed into microgrids, offers an additional benefit: increased resilience to potential cybersecurity attacks. This high-frequency coefficient of the criteria should be available in all messages (Rajesha K.S. (2017), Nosratabadi S.M. (2017), Kaur A. (2016)).

G. Mode

This information refers to take the overall energy demand / sell energy and the ability to operate in island mode of MG. This It can increase the stability of the system to operate in island mode of MG that a general network problem and can reduce overall production costs from riding too much load and transmitting energy demand is a critical role for the determination of the fairness and efficiency. This high-frequency coefficient of the criteria should be available in all messages.

Microgrid is designed to seamlessly connect or disconnect from the distribution system. When connected to the grid, the phase, voltage, frequency, and phase angles of the renewable energy generation sources, batteries and system loads are synchronized to the grid.

1. Supply to Grid: Microgrid is connected to the distribution system and is supplying energy to the grid using renewable solar or wind power. Stored electricity from the Sodium Nickel Chloride, Lithium Ion Battery and Lead Acid Battery Systems can also be used to supply energy to the grid. During the Supply to Grid operating mode, the natural gas generator will not be operated.

2. Supply from Grid: Microgrid is connected to the distribution system and is taking energy from the grid to power its load. Electricity can also be stored in the Sodium Nickel Chloride, Lithium Ion Battery and Lead Acid

Battery Systems for future consumption. During the Supply from Grid operating mode, the solar photovoltaic system and wind turbine system may also be powering the load and charging the batteries, but the natural gas generator will not be operated.

3. Island (Generator): Microgrid is designed to operate in isolation from the distribution grid with the Island (Generator) operating mode. During this mode, the natural gas generator will be the primary source of electricity with the renewable solar and wind generators providing supplementary power. Electricity stored in the Lead Acid, Sodium Nickel Chloride and Lithium Ion Battery Systems can also be used at this time.

4. Island (No Generator): Microgrid is designed to operate in isolation from the distribution grid with the Island (No Generator) operating mode. During this mode renewable solar and wind generators will be primary source of power. Electricity stored in the Lead Acid, Sodium Nickel Chloride and Lithium Ion Battery Systems can also be used at this time. Since all generation sources are intermittent with this operating mode, low priority Microgrid loads may be disconnected depending on the amount of generation available.

5. Black Start: Microgrid is designed to have black start capability that involves using backup systems to help launch the Microgrid's generation sources. During this mode, the Microgrid is not connected to the distribution system and does not have electricity serving its load. The Microgrid will use the backup systems to initiate the renewable generation sources and connect the battery systems to help restore power to system loads.

6. Unintentional Grid Outage (Generator): Microgrid is designed to operate in the event of an outage on the distribution system and provide seamless service to its loads. In this scenario, the Microgrid will automatically disconnect from the grid and start drawing electricity from the natural gas generator, renewable energy sources and battery systems.

7. Unintentional Grid Outage (No Generator): Microgrid is designed to operate in the event of an outage on the distribution system and provide seamless service to its loads. In this scenario, the Microgrid will automatically disconnect from the grid and start drawing electricity from renewable energy sources and battery systems. Since only intermittent generation sources are available, low priority Microgrid loads may be disconnected depending on the amount of generation available.

8. Intentional Grid Outage (Generator): Microgrid is designed to operate in the event of an outage of the distribution system and provide seamless service to its loads. Utilities from time-to-time have planned outages to allow for maintenance and servicing. In this scenario, the Microgrid will automatically disconnect from the grid and start drawing electricity from the natural gas generator, renewable energy sources and battery systems. Since this operating mode involves a planned outage, the battery systems can be fully charged ahead of time to maximize the amount of power for loads during the outage.

9. Intentional Grid Outage (No Generator): Microgrid is designed to operate in the event of an outage on the distribution system and provide seamless service to its loads. Utilities from time-to-time have planned outages to allow for maintenance and servicing. In this scenario, the Microgrid will automatically disconnect from the grid and start drawing electricity from renewable energy sources and battery systems. This operating mode involves a planned outage and hence the battery systems can be fully charged ahead of time to maximize the amount of power for loads during the outage. However, since only intermittent generation sources are available, low priority Microgrid loads may be disconnected depending on the amount of generation available (Yang P. (2017), Mahmood H. (2017), Han Y. (2017), Karavasa C.S. (2018)).

H. Amount of Demand

This information refers to how many kilowatts of energy to get the MG and how much energy wants to sell. MGMS will be decided in terms of fair trading in energy and energy efficiency will play an active role to be taken by using this information. This high-frequency coefficient of the criteria should be available in all messages.

I. Load Type

This information refers priority load information of MG (hospital / school, etc.) and indicate the severity. Removed from the system and some of the burden when it is necessary to increase the stability of the overall system must be transmitted this information. Due to the change of frequency coefficients can't be sustained these criteria is low and is expected to be sent once a day.

J. Special Information

After using energy market in smart grid concept, distribution companies or intelligent networks of bilateral agreements (protocols) could do with a center will take in terms of equitable energy trading and energy efficiency to be taken by the organization will play an active role in determining decisions. Whether with advanced metering infrastructure system gives detailed information on how to communicate MGMS with MGs belonging to the counter information. Failure and maintenance information should also be communicated to increase the stability of the overall system. Due to the change of frequency coefficients can't be sustained these criteria is low and is expected to be sent once a day.

Data Package

In this study, it is desired to develop a data package with relevant data that will be used for the MG in the system. While developing the data package, the criteria of MG is established. It is also considered that the data package must be flexible and open to insert additional fields reserved area in the future. In addition, the packing process data in terms of the communication speed is important, therefore some of these criteria of MG are provided for continuously, while others are planned to be sent out within days. As the length of 24 bytes of data packets (low + high importance) and 16 bytes (high importance) information about the shows in Table 1.

Table 1. Data Package

Information	Length (# bytes)	Importance
Address	2	High
Time	5	High
Energy Conversion Method	1	Low
Generation Power	2	High
Storage Type	1	Low
Storage Capacity	2	High
Mode	1	High
Amount of Demand	2	High
Load Type	1	High
Reserved Area	6	Low
Checksum	1	High

As values can be received by the address information represents 1-65536 MG connected to the system. Time information is in "hhmmssddmmyy" format of this information (the number) is a binary response. Generation type, storage type, mode and load characteristics information is shown Table 2 in below. A microgrid for example in terms of flexibility of the data package in the table below both the photovoltaic and the wind is also allowed various combinations can produce the sum of the indicated value. These combinations generation type, storage type, load type and can be applied to mode. Power generation, power storage, amount of demand response is a binary value of the information in kW. Reserved Area for a "0" value is used. The checksum value is the sum of all the mod operation of 256 bytes in the data packet until checksums.

Table 2. Format for Energy Conversion Method, Storage Type, Load Type and Mode

Energy Conversion Method	Storage Type	Load Type	Mode	Binary Equal
Null	Null	Null	Null	00000000
Photovoltaic	Lead-acid	Hospital	Sell	00000001
Wind	Hydrogen	School	Purchase	00000010
Natural Gas Gen.	Lithium-Ion	Factory	Island Mode	00000100
Diesel Generator	Electrical Veh.	Reserved Area	Grid Mode	00001000
Cogeneration	Mechanical	Reserved Area	Reserved Area	00010000
Biofuels Generator	Reserved Area	Reserved Area	Reserved Area	00100000
Reserved Area	Reserved Area	Reserved Area	Reserved Area	01000000
Reserved Area	Reserved Area	Users	Island Mode Cap.	10000000

According to the sample scenario (Scenario #1) data package to be transmitted one time in days is shown in Figure 1. In data package, the address of MG is 1 (0x00 0x01), with the time stamp of creation of the data packet is 12:03 18.02.2016 (0x00 0x47 0xb7 0x12 0xb8), MG has the energy conversion method both solar and wind (0x03), generation power is 256 kW (0x01 0x00,) storage-type is lithium ion battery (0x04), and the storage capacity of 100 kW (0x00 0x64), where the ability of the energy purchase requisition to operate in island mode (0x81), receiving energy demand is 1 MW (0x03 0xe8), MG has several types of load which are end users and school load (0x82).

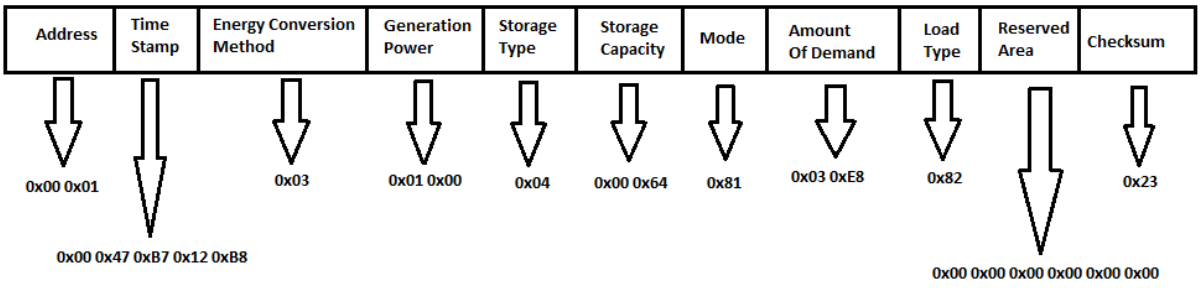

Figure 1. Data Package for Sample Scenario #1

According to another scenario (Scenario #2), during the day continuous data package to be sent is shown in Figure 2. The address of MG is 1 (0x00 0x01), with the time stamp of creation of the data package 12:15 18.02.2016 (0x00 0x48 0x6 to 0x2D 0xb8), the generation power is 256 kW (0x01 0x00), and the storage reserves of MG is 100 kW (0x00 0x64), where the ability of the energy purchase requisition to operate in island mode (0x81), receiving energy demand of MG is 1 MW (0x03 0xe8), MG has several types of load which are end users and school (0x82).

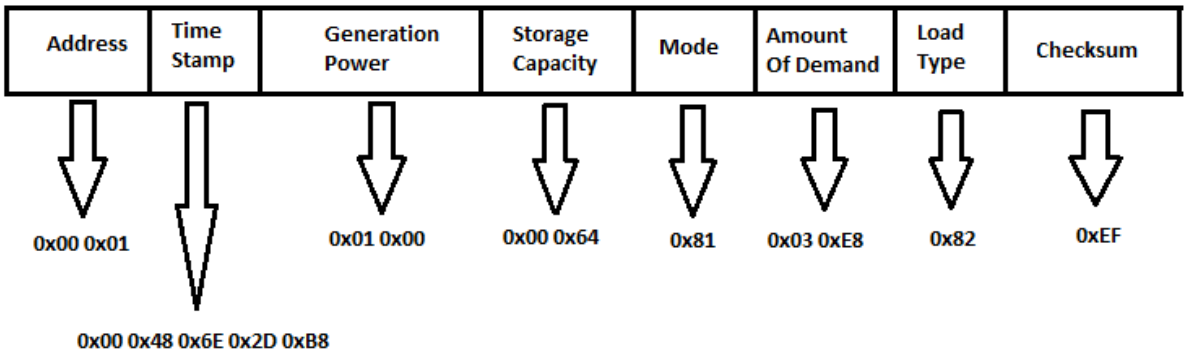

Figure 2. Data Package for Sample Scenario #2

Communication Architecture Section

In this section, necessary communication architecture to control and monitor MG was examined. The system architecture is presented in Figure 3. The data, which are important for a MG, is gathered by an answer-question communication with the EMS (Energy Management System) located in the MG via a hardware and software integrated to the MG. These information are converted to a data package and can be instantaneously and periodically sent to MGMS with necessary protection level. MGMS must merge the grid information, meteorological information, smart grid central control center, and MG status data and then control the MGs and run decision mechanisms to market main grid to run stably.

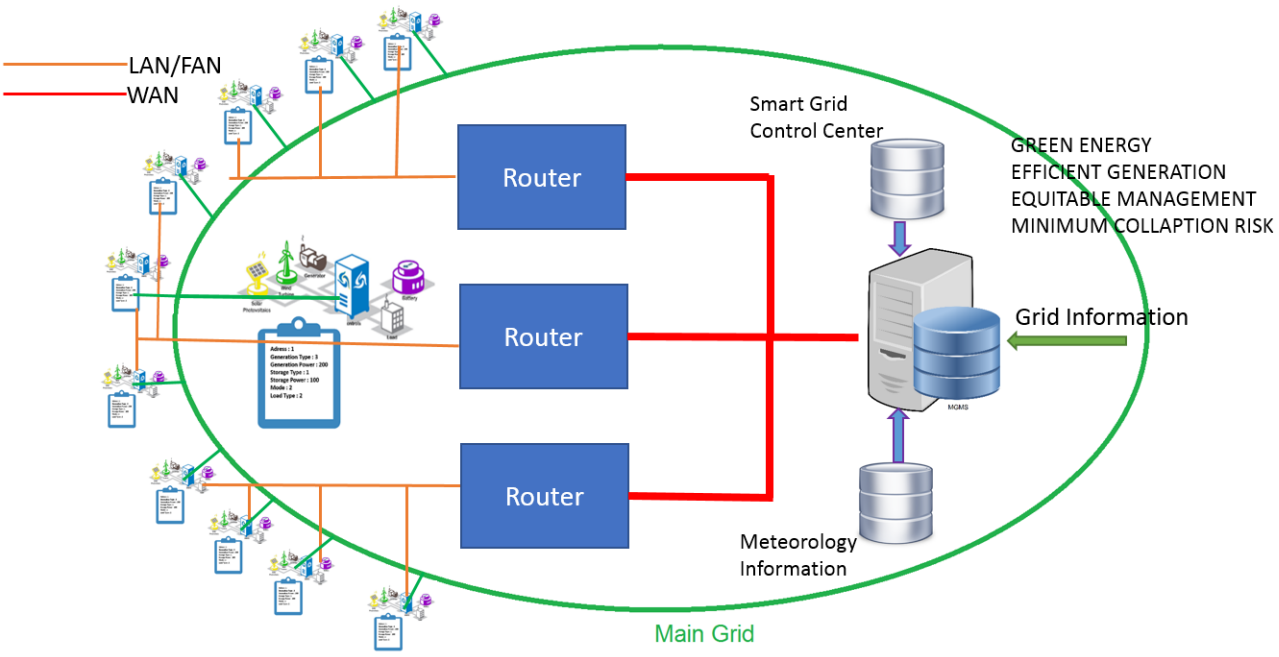

Figure 3. Communication System Architecture

In smart grid used in domestic and smart meter communication between is HAN, overall user communication between the distribution networks is LAN / FAN, generally provide communication with the generation and transformation centers with centers with WAN (Mehra T. (2013)). If not up to any standard this time according to academically study, WAN communications are used to plan Cellular, WiMax, Fiber communication technologies, LAN / FAN communications are used to plan WiMAX RF, DSL communication technologies, HAN communications are used to plan Zigbee, Wi-Fi, stands out the use of PLC communication technology. Supports intelligent in studies on communication for smart grid HAN network coverage in the literature, LAN / WAN networks and FAN and general requirements to be used in smart grid applications are indicated (Yan Y. (2012)). In addition to these studies, different sections of the communications technologies and work on limits and coverage of this communication technology is made for smart grids (Melvin H.(2014)). Wi-Fi availability for MG information of communication technology, but they also envisage making improvements in the security requirements of this technology. In addition, data from the receiving profile and the actual system requirements and safety problems for manufacturers to package the results are sought (Shukla S. (2014), Nthontho M. P. (2012)). Fixed WiMAX for MG as an enabling rapid deployment and cost-effectiveness showed higher can be used for data transmission. Thus, both set up wireless networks may be more practical and reliable in rural and remote areas (Weimer J. (2012)).In this study, the MG information is displayed, and although there is no standard for communication required to be controlled from a central restricts geographical between MGMS with MG, data speed, accuracy and time delay issues considering the LAN / FAN and WAN networks are planned. Wi-Fi technology for their communication systems, DSL and 3G / 4G the use of technology is considered.

Conclusions

Numerous orders to make effective control of certain centers of the MG is very well identifying information will be taken from MGs information, a known evaluation and should be forwarded to MG the most appropriate

communications technology is real. In this study, it conducted a study to determine the information to be received from different type MG characteristics.

In this study; unlike other studies, production type, load priority metric, the ability to work the island mode, made between general system and MG are specific protocols, whether or not having a system of advanced metering infrastructure, the introduction of the failure and maintenance information considered and this information is added to the data package. Second, a study on what can be placed in a data package identification information made and criteria then converted into numerical metric, respectively, Address, Time, Generation Type, Generation Power, Storage Type, Storage Power, Mode, Amount of Demand, Load Type, Reserved area (special information) and agreed that it would be appropriate to use a structure in the form of checksum.

In addition, intelligent networks that can be used within the scope of communications technologies examined, communication technologies used by the generated data packets which conducted a review of the need for it. According to this investigation Wi-Fi, DSL and 3G / 4G of communications technology has been determined to be appropriate. In conclusion, this study will contribute very significantly to the standards development work carried out in MG, MG information are among the fair and will pave the provision of effective management, and however, is expected to serve as an example in the selection of appropriate communication technologies should be used.

The future studies presented in this article is planned to be expanded taking into account the following issues and these studies on this issue are ongoing.

- After the data acquisition related to the MG energy management system hardware integration with selection the proper equipment to perform casual work is planned to develop embedded software.
- Control and commands will be created and will be produced by MGMS
- Consideration of the similarities between AMI systems with existing building is planned to be enhanced and improved the structure of the debate to be taken up and combined with the AMI in the group that prepared this paper.
- The electrical network system flexibility on the demand side of the issue is one of the issues that need to be developed and make them flexible choice of MG information allows eligible consumers connected to the data packages generated in this study was a planned operation will slightly improve.
- A study on how to use can be made of flexible structure and packet data networks using the data package MG relationships with service providers is planned.

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ENVIRONMENT OF CULTURE AND ART IN THE OTTOMAN EMPIRE IN 19th CENTURY

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Abstract: Westernisation and modernisation of the Ottoman Empire began to burgeon in the 17th century; it became evident in the 18th century and the 19th century witnessed the most intense interaction and the exact reconstruction process. New way of living which was originated in Europe and representatives thereof became influential as guides and determinants of reconstruction process in the Ottoman Empire. It is possible to point out that the Ottoman Empire which got closer to France for handling military problems, to England for industrialisation purposes and to Italy for architecture and arts had intense communication and the resulting interaction with European states in the course of reconstruction process.
This study aims to give information about the social, cultural and artistic environment in the Ottoman Empire during the reign of Sultan Abdul Hamid II (1876-1909).

Key Words: Culture, Art, Ottoman Empire, Sultan Abdul Hamid II.

General View of the Environment of Culture and Art in 19th Century in the Ottoman Empire

It is clear that sultans had a very important role in the ruling of the country as a part of state system of the Ottoman Empire thus, good or bad functioning of the state and events and actions which might affect the society from various aspects were closely connected to personality, behaviours and mentality of the sultan. This fact which is valid for all absolute monarchies rendered the personality of sultans very important for ruling of the state and events, practices and behaviours which might affect the society based on the ruling in a country like Ottoman Empire majority of whose population was illiterate. Therefore, westernisation movements in our history were primarily shaped in line with the personality, mentality, philosophy, behaviours and ruling capacity of the sultans. Artistic issues would inevitably undergo a transformation process depending on the same environment and circumstances (Cezar, 1971: 19).

Although the transfer of some cultural elements had a preliminary function in the adoption of Western art in the Ottoman Empire, the main motivation was the beginning of disintegration of Ottoman society upon the change of land order at the end of 16th century (Renda and Erol, 1980: 79). New diplomatic, commercial and cultural relations with European states in 18th century had a significant effect on artistic environment of the Ottoman Empire. One of the most important innovations was surely the introduction of the printing to the Ottoman Empire following the mission of Mehmed Çelebi and Said Efendi in Paris. Said Efendi had İbrahim Müteferrika establish the first printing house in 1726 and initiated the publishing of books in Turkish.

It is evident that westerners exerted efforts for familiarizing themselves with Turkey in that century. Envoys arriving in Istanbul started to bring scientists, intellectuals, painters with themselves even in the Tulip Period. These developments even enhanced and continued in the course of events. Westerners were studying history, state organisation, social structure of Turkey and they were publishing articles and books based on these studies. Painters who accompanied envoys or came on their own were depicting buildings, clothes and way of living in Turkey with their pencil or brushes (Cezar, 1971: 7).

Institutional Westernisation which was accomplished by successively innovative sultans during 18th and 19th century which were identified as reconstruction period in the Ottoman history resulted in a comprehensive cultural evolution in the empire. This period witnessed the formation of a new cultural and artistic environment in the country and trial of new forms and techniques of each branch of art and gradual institutionalisation of art education. A new phase was also introduced for Ottoman painting in this period (Bağcı et al., 2006: 261). Given that these changes were resulted from impacts of economic depression on social life and culture in the Ottoman Empire and art works of this environment were inseparably connected to historical process thereof, it is clear that westernisation in painting was an extension of social changes (Fischer, 1995: 163).

Commencement of painting education under the auspices of court in the 19th century enabled the training of painters who were creating art works in western style. Newly established technical schools offered a modern

curriculum and lectures of math, geometry and technical drawing. Firstly Mühendishane-i Bahri-i Hümayun (Imperial School of Naval Engineering), Mühendishane-i Berri-i Hümayun (Imperial School of Military Engineering) then Mekteb-i Harbiye (School of War) and schools like Sanayi and Mülkiye Mektebi (Industrial and Civil Service Schools), civil high schools, teacher-training schools following Tanzimat reform era were the centres of painting education until the foundation of Sanayi-i Nefise Mektebi (Academy of Fine Arts) in 1883 (Bağcı et al., 2006: 300). However, design and painting lectures might have been held in studios of some painters apart from abovementioned official institutions. As noted previously, it is known that some European painters arriving in Istanbul in 18th century had studios in Galata district and Levantines, non-Muslim and Muslim painters came and worked in these studios. It should be considered that European painters who stayed in Istanbul for a longer period and worked at court's service in the 19th century played a greater role in the adoption of the western painting (Renda, 2002: 948).

Renewal concepts which were tried to be identified as Westernisation process in Turkey brought about the prejudice that the sole factor designating the changes of form was Europe. It is not possible to point out that a particular art environment is deprived of an internal dynamism where connection with its historical creative volition and its traditions is sustained in spite of very powerful exposure and that it is incorporated in modern developments (Tansuğ, 1986: 11).

Environment of Culture and Art under the Rule of Sultan Abdul Hamid II (1876-1909)

Sultan Abdul Hamid II who might be identified as innovative due to developments under his rule witnessed very important political events of the imperial history. He announced the first Ottoman constitution (Kanûn-i Esasî) on December 23, 1876. The first parliament consisting of the Sultan-selected Senate and generally elected Chamber of Deputies opened on March 19, 1877. Thus, the First Constitutional Era started. This period which was designated as era of innovations in the empire had impacts not only on political life but also on social and cultural life. The interest of Sultan Abdul Hamid II in fine arts flourished as a result of taste of Ottoman court in the 19th century and his presence in visit of Abdul Aziz to Europe before he took the throne (Germaner and İnankur, 2002: 104).

Artistic activities of particularly foreign architects were outstanding under the rule of Sultan Abdul Hamid II who attached importance to culture, art and architecture. Private academy of the French artist Guillemet[1] was active in Pera district prior to foundation of Sanayi-i Nefise Mektebi (Academy of Fine Arts) in 1883. Pera as a European cultural zone hosted the activities of foreigners, Levantines or artists of minority. Vividness of artistic life was sustained during First Constitutional Era (1876–1908) which spanned the rule of Sultan Abdul Hamid II (Tansuğ, 1993: 15).

[1] Pierre Desire Guillemet (1828-1878): Is a French painter who came to Istanbul during the reign of Abdul Aziz, the second sultan of the Tanzimat period, during the process of westernization. After being sent to Turkey with an official mission in 1863, he made portraits of Sultan Abdul Aziz, one of them standing on the horse. In the 1870s, the artist produced works showing women from the harem of the Ottoman Palace as well as another copy of the standing portrait of Abdul Aziz. The last piece we know of the artist is II. Abdul Hamid is probably the portrait portraying the first years of his reign. All of these artistic activities, which Guillemet put forward in connection with the two different cultures of Europe and Ottoman, in the context of the relations between the traditional and the modern transformation, have made permanent contributions to the history of contemporary Turkish art (Kıbrıs, 2003). (http://tez.yok.gov.tr/UlusalTezMerkezi/SearchTez) (Date of Access: 11.12.2013)

Figure 1: Sanayi-i Nefise Mektebi (Academy of Fine Arts)

It appears that understanding of western painting attracted the attention and support of statesmen and aristocrats resident in Istanbul beginning from the rule of Sultan Abdul Aziz even though this understanding could not be rendered available for a vast majority of public. Thus, "Sanayi-i Nefise Mekteb-i Âlisi" (Academy of Fine Arts) was founded in Istanbul in 1882 upon the initiative of government in order to institutionalise understanding of western art and activities thereof in Turkey and modern artistic activities primarily painting, sculpture and architecture were tried to be taught and made available to majority of public through this school. In fact, obstacles to descriptive painting which was forbidden by Islam and deemed as a taboo thus could not be developed could only be overcome through enduring and extensive efforts. It is a historical fact that European artists particularly Italians arriving in Turkey as well as stance and support of Ottoman administration particularly from the beginning of 19th century played an important role in overcoming these obstacles (Sönmez, 2006: 313).

The most important event for the history of painting was the foundation of Sanayi-i Nefise (Academy of Fine Arts), art education was demilitarised by means of the school. The school which was founded by Osman Hamdi Bey who received education of painting in Paris together with the support of court following a long preparatory period started to operate on March 3, 1883. Osman Hamdi Bey was always criticised due to academic staff which was mainly composed of foreign and non-Muslim academicians such as Alexandre Vallaury for teaching science of architecture and his assistant Pietro Bellò, Salvatore Valéri for oil painting, Warnia Zarzecki for sketching, Yervant Osgan Effendi for sculpture and Aristo Efendi for history. However, it might be thought that he established such a group of academicians since he wanted to concentrate on figure which he attached utmost importance (Arlı, 2000: 147). The attitude of Ottoman sultans was also evident from the fact that they ordered court painters who was invited from West such as Zonaro, Chlebowski to create large paintings depicting the victories of their ancestors (Çağman, 2002: 931).

Figure 2: Ertuğrul Süvari Alayı'nın Galata Köprüsü'nden Geçişi
(Passage of Ertugrul Cavalcade from Galata Bridge), 1901
Fausto Zonaro
Oil on canvas,
117x202 cm.

Figure 3: Kağıthane, Date Unknown
Stanislas Chlebowski
Oil on canvas
62x102 cm.

Factors resulting in the acceleration of cultural and artistic environment of Sultan Abdul Hamid II and dynamics reflecting in the art works of the period might be summarized as follows (Yasa-Yaman, 2011: 20);

> "Famous photographers of Pera took the photos of urban life, monuments, historical surrounding, bazaars, streets, peddlers, ceremonies, portraits of notables of that period, members of foreign royal families visiting the empire, travellers, admirals of Ottoman Navy, foreign navies, new hospitals and schools, official ceremonies, daily life and events, life of women particularly in public and private areas, portraits of important people and albums and postcards became popular under the rule of Sultan Abdul Hamid II. Picture, engraving and particularly photographs were important sources affecting the theme-related repertoire and vision of painters."

Reign of Sultan Abdul Hamid II was also important for portrait-painting of sultans since Sultan Abdul Hamid II ordered the Europeans such as H. Bertaux, F. Zonaro, W. Reuter to create the oil portraits of preceding sultans. Sultan also established a museum inside Yıldız Palace and exhibited the portraits of sultans and some paintings from court collections as well as artefacts such as coins, porcelains, manuscripts etc. (Renda, 2002: 947).

Figure 4: Antikacı (Antique Dealer), Date unknown
Salvatore Valéri
Oil on canvas
60x44 cm.

Turkish Artists in the 19th Century Ottoman Art Environment

In the 19th century only foreign painters did not give work in the Ottoman Empire. During this period, the artists who went to Europe and trained in perspective, shadow, color toning and the use of these techniques developed themselves in painting Western style paintings. When we are going to touch Turkish painters of this period, we should not mention "Military Painters". The Ottoman state is clearly based on the military plan, and this is also the area where it is most sensitive. The reorganization of the military order in the direction of westernization led to the establishment of military schools with the name of Mühendishane-i Bahr-i Hümayun (1773), followed by Mühendishane-i Berri-i Hümayun (1793). These schools and military officers, such as the Harbiye (1831), were

later turned into artistic studies in the hands of their talents and created a military painter who is unprecedented in the world (Tansuğ, 1993: 11).

Some artists, military or civilian school graduates who make their paintings using the photographs taken by Abdullah Brothers[2], the first famous photographer of Istanbul, are much unknown to life stories, and they come as a unique group in 19th century painting activities. These artists, such as Hüseyin Giritli, Hilmi Kasımpaşalı, Fahri Kaptan, Necip, Selahaddin, Salih Molla Aşkî, Ahmet Bedri, Münip, Ahmet Şekûr, Ahmet Ziya Şam, İbrahim, Mustafa, Şefik, Şevki, Osman Nuri are known as one, two or three paintings (Tansuğ, 1986: 85).

In the 19th century, the strong representatives of the new understanding of painting towards the West became artists who were sent to painting education in Europe. After the Tanzimat the innovative sultans Sultan Abdul Mecid and Abdul Aziz sent these artists to Paris for education as well as established a school under the name of Mekteb-i Osmanî in Paris in order to educate them and the school which served between 1860-1874, it was obtained. There are records of the paintings of the painters, such as Ferik İbrahim Pasha (died in 1891), Hüsnü Yusuf Bey (died in 1861) and Ahmed Emin Bey (died in 1891) who were sent abroad during Abdul Mecid period, as well as canvas paintings (Bağcı et al., 2006: 301). In addition to all these artists who made up the Ottoman art scene, we can also consider Şeker Ahmed Pasha (Ahmed Ali died in 1907), who was first educated at the Academy of Fine Arts at Mekteb-i Osmani and later at the Paris Fine Arts Academy, as the pioneer of these painters. Şeker Ahmed Pasha, attracted the attention of Sultan Abdul Aziz at the 1867 Paris World Fair, was appointed as a minister in his turn and was also commissioned to create a collection of paintings at the same time. Şeker Ahmed Pasha also organized the first collective art exhibition in Istanbul in 1873 (Bağcı et al., 1996: 301-302).

Figure 5: Otoportre, (Self-portrait), Date unknown
Şeker Ahmed Paşa (Şeker Ahmed Pasha)
Oil on canvas
116x84 cm.

[2] It is the commercial name of Vicen (1820-1902), Hovsep Abdullahyan (1830-1908) and Kevork (1839-1918) brothers, all of whom are Armenian-renowned as the founders of the art of photography in Turkey. In 1858 a photographer shop was opened in Istanbul near Tunel. They were rewarded by Abdul Aziz and Abdul Hamid II with the title of artist painter (painter of the sultan).

Another painter who went to Paris and studied was Süleyman Seyyid (died in 1913). Süleyman Seyyid's soft brush technique and strong light use, which are mostly known for their still life but also have scenes, figurative paintings and portraits, draw attention. Both Şeker Ahmed Pasha and Süleyman Seyyid depart from the 19th century viewers who took photographs or engravings as examples (Bağcı et al., 1996: 302). From Turkish painters who went to Paris for the first time, Şeker Ahmed Pasha and Süleyman Seyyid's naturalism and Barbizon School's[3] orientation to the landscape are linked to the world of art from 1860-70, as well as their own worldviews. They have become spectators of Courbet's image (Germaner, 1999: 119). Another representative of the painters who studied in Paris is Halil Pasha (died in 1939). His distinction from his other is that he is closer to the impressionist painting with his vibrant colors, thick brush strokes, flickering light stains (Bağcı et al., 1996: 303).

Osman Hamdi Bey (died in 1917) is another artist who had not attended military school in the second half of the 19th century but had studied in Paris. Osman Hamdi, who is also an archaeologist and founder of both the Archaeological Museum and Sanayi-i Nefise Mektebi, has a privileged place in Ottoman art. The greatest contribution of Osman Hamdi Bey, who is the forerunner of figurative illustration and portraiture, is that he has placed human beings, especially women, in monumental dimensions. In Paris he was influenced by orientalist movement and used Ottoman decorations and clothes in his paintings. But like European Orientalists, he has not tried to create a mysterious Eastern world of imagination. Realistic decorations and people are part of the Ottoman culture. Osman Hamdi established the School of Industry in 1883 and established the institution of painting education. Painters studying here will bring more innovative trends to painting in the early 20th century. Most of these painters will continue their activities during the Republican period and will accelerate the republican era (Bağcı vd., 1996: 303).

Figure 6: Osman Hamdi Bey

The Ottoman artist who went to Paris met a metropolis that attracted the pain of industrialism unlike orientalists who were fascinated by the mystical life of the eastern cities. For the first time, they discovered the existence of great museums, galleries and intense art scene. While European artists working in the east gradually moved away from

[3] The Barbizon School is used to describe the landscape picture style of the 19th century, which was applied by a French painter group between 1830 and 1870. It is from the Barbizon village near Fontainebleau (France) where the painters of the school come together. Among the leading names of the Barbizon school are Jean-Baptiste Camille Corot, Théodore Rousseau, Jean-François Millet and Charles-François Daubigny. Barbizon painters were part of the road to reality when romanticism prevailed in visual arts.

academic education and valid rules, the Ottoman artist found himself in a new style of workshop education (Germaner, 1999: 119).

Some Ottoman painters who did not go to Europe also took an important place in the history of painting. They seem to be influenced by Orientalist painters who came to Istanbul. For example, Hüseyin Zekai Pasha (died in 1917) was known for his landscaped buildings. Ahmed Ziya Akbulut (died in 1938), who made the same kind of paintings, wrote two books on the perspective of Amel-i Menâzır and Ameliye-i Fenn-i Menâzir (Bağcı et al., 1996: 303). Hoca Ali Rıza (1857-1930) was the painter who attracted attention with the innovative style of 19th century Turkish painters who had not been educated in Europe. As a matter of fact, Hoca Ali Rıza and Halil Pasha, Şeker Ahmed Pasha and Süleyman Seyyid form the bridge between the painters who brought impression of Turkish painting to the beginning of the 20th century (Renda, 2002: 952-953).

Conclusion

It is pointed out that Western figurative painting was first introduced by Italian Gentile Bellini under the rule of Mehmed the Conqueror in the researches on Turkish art history and development of Turkish painting. Accordingly, it is known that portraits of Selim III, Mahmud II and their successors were created as a part of portrait painting of sultans. However, the depiction of public, scenes from daily life, ceremonies, feasts, cafes etc. in the imperial territories started in the 19th century and it gained. This process is included in Turkish painting history as "arrival of Western painting to Ottoman Empire or Turkey".

It is consequently known that numerous European artists arrived in Ottoman territories in the 19th century and some of them came upon the court invitation and some of them were residing in Istanbul for work. In all these developments, it is possible to say that the contribution of Turkish artists as well as European or foreign artists in the development of the Ottoman art scene and in the establishment of art in the Western sense is possible. It is the "art" that is able to effect and spread quickly and easily among the societies. Collecting the source of art, together with being connected to the culture structure of the powerful society, has freedom and individuality depending on it (Cezar, 1971: 2). In the 18th century and the first half of the nineteenth century, which constituted the first period of Westernization in the Ottoman Empire, art traces a culture change that new conditions pose. In this environment, it can be seen that both in architecture, in the field of painting, Western forms are adopted to a great extent, and in some places they are copied and copied in some places. The miniature, the sole dominant species of Turkish painting, has also gradually left its place in the Western sense (Renda, 1977: 193).

As a result, the 19th century Ottoman culture-art scene emerged as a result of the co-productions of foreign and Turkish artists and the influence of these artists in the 20th century. In the formation of contemporary Turkish art lies the tradition of Turkish painting which comes from the miniature tradition and completes the evolution with Western artifacts.

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EXTRACTION OF THE ACOUSTIC FEATURES OF SEMI-VOWELS IN THE KURDISH LANGUAGE

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Abstract: In this study, it was aimed to extract the acoustic features of semi-vowels in the Kurdish language spoken in Turkey at the phoneme level. For this purpose, voice recordings were collected from 42 adult speakers who know how to read and write in Kurdish. The isolated voice signals of the data set generated with these recordings were obtained by Praat software. The acoustic features of the isolated semi-vowels obtained were acquired by extracting the F1, F2, F3 and F4 formant frequencies in the Matlab environment using the LPC method. Semi-vowels, the phonetic analysis of which was examined, were then addressed with vowels at the end of this study, and their similarities and differences in terms of the phonetic feature were revealed according to the examination results of the analyzed data. This is the first study in which the acoustic analysis of Kurdish semi-vowels was performed. This study will contribute to the researchers who will carry out studies on Kurdish voice processing systems in the future.
Keywords: Speech processing, Kurdish, Phonetic feature, Formant frequency analysis, Lpc, Praat.

Introduction

Kurdish is an Iranian language of the Indo-Iranian language group of the Indo-European language family in terms of the language family and is an inflected language when examined in terms of the structure. Kurdish communities speak many different dialects, including Kurmanji, Sorani, Lori, Gorani, and Zazaki, according to the regions they live in and the tribes and principalities they depend on (Ciwan., 1992). In this study, the Kurmanji dialect, the most spoken dialect of the Kurdish language, is taken as a basis. Kurdish is the most spoken language in Turkey among the living languages following the Turkish language. Therefore, in this study, the acoustic structure of the phonemes in Kurdish was examined in order to develop the voice processing applications such as speech recognition, speaker recognition, voice to text, and text to voice, in the Kurdish language using biometric data consisting of Kurdish sound signals for the determination of crimes committed in Turkey. The examinations were carried out with the sorting of the formant frequencies of the isolated semivowel phonemes in Kurdish.

Formant frequencies are the resonance frequencies of the vocal tract that are expressed as the peak amplitude in the frequency spectrum of the sound. With these frequencies, the most important acoustic properties of semivowels were obtained.

Formation Process of Semivowels and Vowels

The speech signal is produced as a result of the vibrating of airflow coming from the lungs in vocal cords and passing of the vibrations through the throat, oral cavity, and nasal cavity and forming in the tongue, teeth, jaws, palates, and lips, the articulator structures. The smallest sound units that make up a spoken language consist of vowels and consonants. Vowels are the voiced sounds produced by the oscillation as a result of the vibrating of vocal cords. Consonants are the sounds produced by the obstacles against the airflow in the vocal tract. For this reason, the vocal cord vibrations do not have any significance in the production process of consonants. However, this is not the case for the production of every consonant. Thus, vowels and some of the consonants are voiced. This is also observed in the semivowels (/w/ and /y/) of Kurdish. When the semivowels are pronounced, they have both the consonant and the voiced sound properties. When examined, while the voiced sounds exhibit a periodic structure, voiceless sounds exhibit a non-periodic structure (Artuner., 1994).

Semivowels in Kurdish

There are two semivowels in Kurdish, being /w/ and /y/. In Kurdish, semivowels are classified into 2 main groups as labial and palatal semivowels by their phonation places as in Table 1.

Table 1: Semivowels in Kurdish.

	Labials	Prepalatals
Semivowels	/w/	/y/

When the semivowels in Kurdish are analysed phonetically, they demonstrate the following properties:

- /w/ sound is a continuous voiced sound pronounced with two lips (Ciwan., 1992, Khan., & Lescot., 1971).
- /y/ sound is a voiced sound pronounced in the prepalate (Ciwan., 1992, Khan., & Lescot., 1971).

Vowels in Kurdish

There are 8 vowels in Kurdish, being /a/, /e/, /ê/, /i/, /î/, /o/, /u/, and /û/. Vowels in Kurdish are classified into 3 main groups as long and short vowels by their pronunciation time when being pronounced, as prepalatal and postpalatal vowels by the motions the tongue has in the prepalate and postpalate in the oral cavity, and as high, mid, and low vowels by the proximity of the tongue to the mandible and palate as in Table 2.

Table 2: Vowels in Kurdish.

	Long Vowels			Short Vowels		
	High	Mid	Low	High	Mid	Low
Prepalate	/î/, /û/	/ê/				/e/
Postpalate			/a/, /o/	/i/, /u/		

The remaining parts of the article are arranged as follows: Materials and methods used are presented in Chapter 2, the formant frequency analysis results of the isolated semivowels are examined in Chapter 3, and a general deduction is made from the obtained results in Chapter 4.

Materials and Methods

In this study, the acoustic properties of Kurdish semivowels were sorted by the formant analysis method. The formant analysis is one of the most important methods used to determine the distinctive properties or significant frequency combinations from the speech data. They are demonstrated with F1, F2, F3, and F4. In this study, the formant analysis values were obtained in Matlab environment with the Linear Predictive Coding (LPC) method, and sound analysis process was performed with Praat software.

The Data Set Used and Its Properties

The properties of the data set formed for the acoustic analysis of Kurdish semivowels are presented in Table 3. The recordings were obtained in a silent room environment with the Easy Voice Recorder Pro voice recording program and General Mobile Discovery II + brand mobile phone.

Table 3: Properties of the database used.

Isolated semivowels	The number of male speakers	The number of female speakers	The age of male speakers	The age of female speakers
/w/	42	8	19-35	21-30
/y/	42	8	19-35	21-30

LPC Method

LPC is a technique used to characterize spectral properties from the sound signals. In this technique, the prediction of the n sample of the speech signal s(n) is expressed as the linear combination of the previous p samples. This is shown in equation 1 and the a_i values in Equation 1 refer to the LPC coefficients (Sel., 2013).

$$S(n) = -\sum_{i=1}^{p} a_i s(n-i) \qquad (1)$$

In the LPC method, the difference between the actual signal value s(n) and the predicted signal value S(n) of the speech equals to the error signal. This is expressed in Equation 2. The LPC coefficients in this method make production to calculate the error signal to be minimum (Sel., 2013).

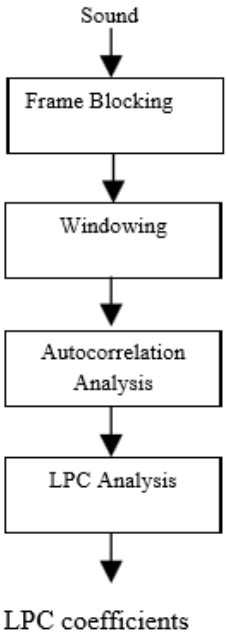
$$e(n) = s(n) - S(n) = s(n) + \sum_{i=1}^{p} a_i s(n-i) \qquad (2)$$

With the z-transfer transformation, a filter with a finite impulse response, which is based on the human vocal tract and its properties, is obtained with the A(z) LPC analysis filter in Equation 3,

$$H(z) = 1 - \sum_{i=1}^{p} a^i z^{-i} = A(z) \qquad (3)$$

Steps of the LPC method

Steps constituting the LPC method are presented in Figure 1.



Şekil 1: The block diagram of the steps constituting the LPC method.

Frame Blocking: It is the processing of the speech signal in a small period of time, especially between 20 and 30 ms, and obtaining more stable characteristics of the speech signal (Karasartova., 2011).

Windowing: It is used to block discontinuous areas at the beginning and end of each framed sound signal. The examples of windowing are Hamming, Hanning, Rectangular, Barlett, and Kaiser. The most commonly used windowing example in voice processing applications is the Hamming windowing. This windowing is expressed by Equation 4 [7]. (The symbol "N" in this equation indicates the number of samples in each frame).

$$w(n) = 0.54 - 0.46\cos\left(\frac{2n\pi}{N-1}\right) \qquad (4)$$

Autocorrelation Analysis: The autocorrelation analysis is performed to each windowed frame signal. The autocorrelation analysis equation is expressed by Equation 5. In this equation, the symbol p indicates the analysis degree that can range from 8 to 16 (Eray., 2008).

$$r_l(m) = \sum_{n=0}^{N-1-m} \hat{x}_l(n) \cdot \hat{x}_l(n+m), m = 0,1,2 \ldots\ldots, p \qquad (5)$$

The LPC Analysis: In this operation, p+1 LPC coefficient values are calculated from each frame applied with the autocorrelation analysis. These calculated values are called the LPC parameters.

Results and Discussion

The mean and standard deviation values of the frequencies F1, F2, F3 and F4 of the semivowels in the data set are presented in Table 4 for male speakers and in Table 5 for female speakers.

Table 4: The mean and standard deviation values of semivowels for males.

	Mean Formant Values			
	F1	**F2**	**F3**	**F4**
/w/	378.305	1056.323	2848.916	4124.831
/y/	299.084	2263.655	3309.581	4300.899
	Standard Deviation Formant Values			
	F1	**F2**	**F3**	**F4**
/w/	38.697	444.588	421.887	655.171
/y/	35.827	395.661	376.336	675.381

When the mean formant frequency values of the male speakers in Table 4 are examined, the format analysis of the semivowels of males is as follows:

- Since the phoneme with the highest F1 value is the /w/ sound, the /w/ phoneme is pronounced more clearly than the /y/ phoneme. In this case, the /y/ phoneme is pronounced more closed than the /w/ phoneme.

- Since the phoneme with the highest F2 value is the /y/ sound, the /y/ phoneme is pronounced more closely to the prepalate than the /w/ phoneme by the position of the tongue.

Table 5: The mean and standard deviation values of semivowels for females.

	Mean Formant Values			
	F1	**F2**	**F3**	**F4**
/w/	405.272	1069.249	3259.623	4447.568
/y/	323.411	2768.787	3835.873	4837.657
	Standard Deviation Formant Values			
	F1	**F2**	**F3**	**F4**
/w/	74.102	290.413	641.514	588.197
/y/	59.256	242.791	344.807	503.110

When the mean formant frequency values of female speakers in Table 5 are examined, it is observed that the format analysis of the semivowels of females shows the same conclusions as male speakers and the mean formant frequency values of female speakers have higher frequency values than male speakers. This is because the female vocal tract is longer than the male vocal tract.

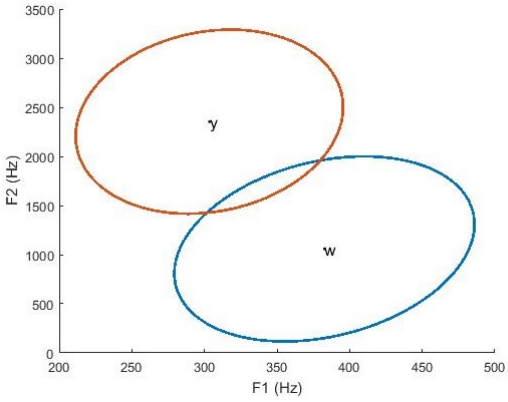


Figure 2: The scatter graph of the mean F1 and F2 frequency values of all speakers for semivowels.

In Figure 2, which is drawn according to the mean and standard deviation results of F1 and F2 frequency values of all speakers for semivowels, it is observed that the F2 formant frequency values of the /y/ semivowel are in areas with high values and the F1 formant frequency values of the /w/ semivowel are in areas with lower values, and the

F1 formant frequency values of the /y/ semivowel are in areas with low values and the F1 formant frequency values of the /w/ semivowel are in areas with higher values.

According to the classification of the vowels (Table 2), it can be said by the shape of the tongue, jaw, and lips when pronouncing semivowels [/w/, /y/] and vowels [/a/,/e/,/ê/,/i/,/î/,/o/,/u/ ,/û/] that;

- The /w/ phoneme shows similar phonetic properties with /a/, /o/, /e/, and /ê/ vowels compared to the /y/ phoneme in terms of the size of the jaw angle and it is different form /î/, /u/, /ı/, and /û/ high vowels.
- The /y/ phoneme shows similar phonetic properties with /e/, /ê/, /î/, and /û/ pre-tongue vowels compared to the /w/ phoneme and it is different form /a/, /o/, /i/, and /u/ post-tongue vowels.

Conclusion

Sorting the acoustic properties of the vowel and semivowel phonemes for the development of the speech processing applications, such as the voice to text and text to voice in Kurdish is of great importance. For this reason, in this study, the vowel and semivowel phonemes in Kurdish were examined, and their characteristic features were sorted. At the same time, the phonetic properties of the isolated semivowels and vowels in Kurdish were introduced, and their pronunciation relations were revealed.

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FACIAL COMPONENT SEGMENTATION USING CONVOLUTIONAL NEURAL NETWORK

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Abstract: Facial components are important for many face image analysis applications. Facial component segmentation is a challenging task due to variations in illumination conditions, pose, scale, skin color etc. Deep learning is a novel branch of machine learning, very efficient in solving complex problems. In this study, we developed a deep Convolutional Neural Network (CNN) to automatically segment facial components in face images. The network has been trained with face images in Radboud face database. Training labels have been created using Face++ SDK. The developed CNN produces a segmentation mask where mouth, eyes, and eyebrows components of the face are marked as foreground. We have focused on these components because they can include very important information for facial image analysis studies such as facial expression recognition. The segmentation success rate of the study is 98.01 according to average accuracy.
Keywords: Convolutional Neural Network, Deep Learning, Facial Feature Extraction, Facial Image Segmentation

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Introduction

Face image analysis tasks such as facial expression recognition, face recognition, face verification etc. have many practical uses in security (Moniruzzaman & Hossain, 2015), traffic (Maralappanavar et al., 2016), and healthcare (Bevilacqua et al., 2011) fields. Facial feature extraction is a fundamental but challenging step in face image analysis because of variations in illumination conditions, head pose and scale, skin color, and other factors such as occlusions, complex backgrounds, etc.

Two main categories of facial feature study and description are holistic description and local feature-based description (Li et al., 2017). Holistic approaches treat and investigate faces as a whole. Principle component analysis (PCA) (Chengjun Liu, 2004) linear discriminant analysis (LDA) (Linsen Wang et al., 2015) and independent component analysis (ICA) (Kwak & Pedrycz, 2007), are common methods for holistic face description. Local feature-based approaches analyze and describe a face in terms of its parts/components rather than as a whole. That can be beneficial for some situation, such as occlusion (Li et al., 2017).

Detection and interpretation of facial components are difficult tasks because of variations in shape, size, appearance, and relative positions of the facial components. Recently, numerous facial feature extraction methods have been proposed. Fang et al.(Fang et al., 2017) proposed a novel partial differential equation based method for facial feature learning. Perakis et al. (Perakis et al., 2014) provided a novel generalized framework of fusion methods for landmark detection. Gong et al. (Gong et al., 2017) presented a new feature descriptor for heterogeneous face recognition. Das et al. Ding et al (Ding et al., 2014) introduced a new color balloon snake model for face segmentation in color images.

Deep learning catches the attention in machine learning and computer vision area because of its outstanding performance. In deep learning approaches, features are learned automatically and complex connections of the data can be resolved (Krizhevsky et al., 2012). Recently deep learning methods have been very popular in face analysis studies such as facial age estimation (Liu et al., 2017), facial beauty prediction (Xu et al., 2017), face detection (Triantafyllidou & Tefas, 2016), face recognition (Zeng et al., 2015), and facial expression recognition studies (Zhang et al., 2017). For instance, Liu et al. (Liu et al., 2017) presented a group-aware deep feature learning approach that learns discriminative face representation for facial age estimation, Ding et al.(Ding & Tao, 2015) proposed a deep learning framework to jointly learn face representation using multimodal information, Mukherjee et al.(Mukherjee & Robertson, 2015) presented a CNN based model for human head pose estimation in low-resolution multi-modal RGB-D data, Fan et al. (Fan & Zhou, 2016) presented a CNN structure for facial landmark localization.

This paper presents a deep learning approach to automatically segment facial components in face images. Viola & Jones face detection algorithm (Viola & Jones, 2001), has been used for face detection and cropping in the database images. We have developed a deep convolutional neural network (CNN) for segmentation of facial components in cropped face images. The network has been trained with face images and corresponding binary facial component masksmarking mouth, eyes, and eyebrows regions of the face. Training masks have been created using Face++ toolbox (Face++, 2017), postprocessing, and visual inspection. These specific components were selected because our ultimate goal is facial expression recognition and mouth, eyes, and eyebrows play and important role in facial expression formation (Lin Zhong et al., 2012).

The rest of the article is structured as follows. Section 2 gives details of the system. Section 3 presents the experimental results. Finally, Section 4 compiles the results of the study and makes suggestions for future studies.

Proposed System

The proposed processing pipeline consists of three steps: (1) face cropping, (2) training data generation, and (3) development, training, and testing of a convolutional neural network (CNN) architecture. Block diagram of the proposed pipeline is shown in Figure 1. Training and testing images are first cropped by Viola&Jones face detection algorithm (Viola & Jones, 2001). Cropped images are then used for training data generation and facial component segmentation as follows.

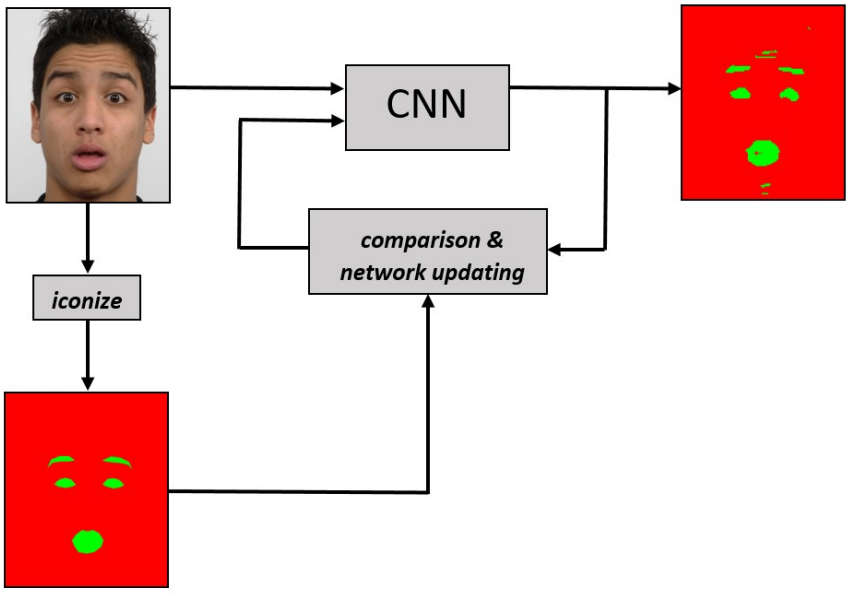


Figure 1. Proposed System

a) Training Data Generation

We have created training masks for facial component segmentation using Face++ SDK (Face++, 2017). The Face++ SDK detects 83 keypoints on human face. With the help of these keypoints, we have created close shapes on human eyes, eyebrows and mouths by polygon fitting to the detected landmark points. Finally, the input images have been iconized. These steps can be seen in Figure 2.

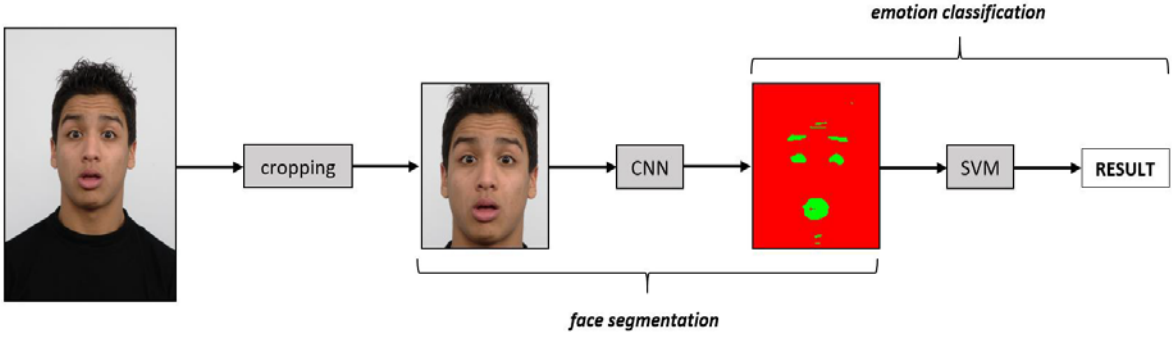


Figure 2. Training data generation steps

b) The Proposed CNN Architecture

We have developed a CNN structure to segment mouth, eyes and eyebrows component in face images. Segmentation is done by classifying 16x16 blocks on the image as background versus facial component. The proposed CNN architecture consists of one batch normalization layer, four convolutional layers (two layers with 16 5x5 filters, one layer with 32 5x5 filters and one layer with 32 4x4 filters), two pooling layers, and one fully connected layer. Training is done with 16x16 non-overlapping blocks extracted from the training image. It has been obtained 345600 blocks totally. Blocks are assigned a training data label based on the percentage of pixels from facial components and background classes. Blocks having 80% or more of their pixels from facial components or background classes, are kept for training, remaining 3018 mixed class blocks are removed from training. 7132 facial components blocks and 335450 background class are obtained.

Testing is done by feeding the whole image to efficiently simulate sliding window processing using the sliding window processing method described in (Shelhamer et al., 2016). Figure 3 illustrates the proposed CNN architecture. Table 1 shows kernel size, number of filters, and input and output size for each convolution layer.

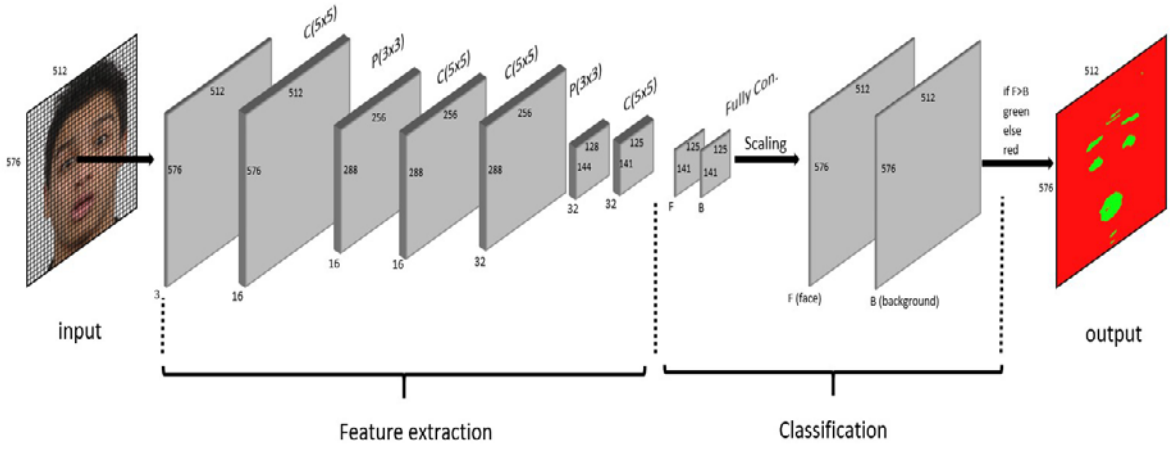


Figure 3.Proposed CNN architecture

Table 1: Detailed layer information for the proposed CNN

Layer	Kernel	Filter	Input	Output
Conv1	5x5	16	576x512x3	576x512x16
Conv2	5x5	16	288x256x16	288x256x16
Conv3	5x5	32	288x256x16	288x256x32
Conv4	4x4	32	144x128x32	141x125x32

Experiments

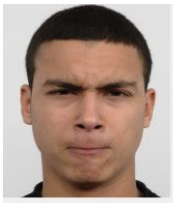
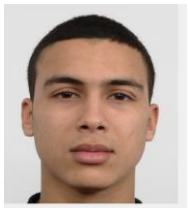
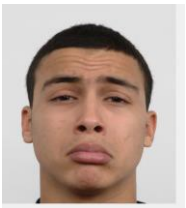
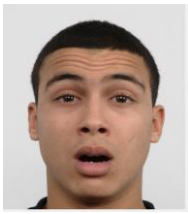
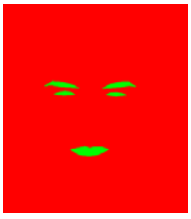
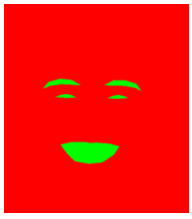
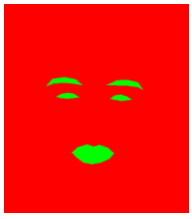
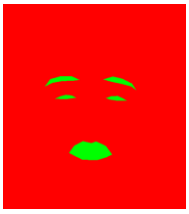
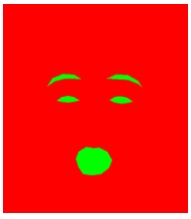
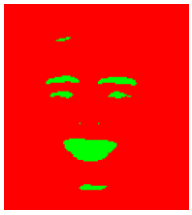
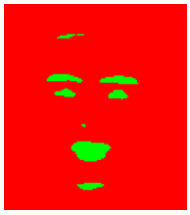
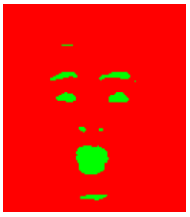
Radboud Face Database (Langner et al., 2010) has been used for training and testing of the proposed network. The images have been resized to 512x576 pixels in order to avoid partial blocks. 335 images have been used for the study (300 for training and 35 for testing).

We evaluated our segmentation result in terms of accuracy as shown in Table 2, where TP, TN, FP, and FN refer to true positives, true negatives, false positives, and false negatives, respectively. As can be seen in the Table 2; our average accuracy is 98.01%. Sample test results can be seen in Table 3.

Table 2: Success rate of our study

Index	Equation	Success Rate (%)
Accuracy (Acc)	$\frac{TP \square TN}{TP \square TN \square FP \square FN}$	98.0133

Table 3: Sample facial component segmentation results.

Expressions	Angry	Happy	Neutral	Sad	Surprised
Original face images					
Training Data					
Segmentation results produced by the proposed system					

Conclusion

In this study, we presented a deep convolutional neural network approach for facial component segmentation. We focused on eyes, eyebrows and mouth components because these components play an important role in facial analysis studies, such as facial expression recognition and head pose estimation. Our next plan is to extend this work to facial expression recognition.

We anticipate that the iconized images obtained using the proposed pipeline will be useful to reduce data size requirements and privacy concerns.

Acknowledgements

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INFLUENCE OF INITIAL VELOCITY ON TRAJECTORIES OF A CHARGED PARTICLE IN UNIFORM PARALLEL ELECTRIC AND MAGNETIC FIELDS

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Abstract: An exploratory study on the trajectory of a charged particle moving in parallel uniform electric and magnetic fields has been carried out where electromagnetic radiation of an accelerated particle is not considered. A general solution for the particle motion equation is derived analytically using a simple method by applying the second Newton's law to the Lorentz force acting on the charged particle. The trajectory is a circular helix with time-dependent pitch. Specific solutions are obtained by varying the initial particle velocity in the absence of electric field. The result shows two basic patterns of trajectories: circular and circular helix with constant pitch. Parameters such as radius and helical pitch for circular helix trajectory as well as radius and its center position for circle trajectory of cyclotron motion can be obtained.

Keywords: Trajectory, Helix, Pitch, Electric field, Magnetic field, Initial velocity

Introduction

The motion of a charged particle in uniform electric and magnetic fields has been discussed in many undergraduate physics textbooks, especially for a straight line trajectory of a charged particle with zero resultant of magnetic and electric forces in a velocity selector (Serway, 1996; Cutnell and Johnson, 2013; Halliday et al., 2011; Benson, 1996). The other frequent topic discussed in the textbooks is a circular trajectory of a charged particle moving in a plane at right angles to a uniform magnetic field (Serway, 1996; Cutnell and Johnson, 2013; Halliday et al., 2011; Benson, 1996; Griffiths, 1989) and if the particle starts with an additional velocity parallel to magnetic field then it moves in a helix (Serway, 1996; Halliday et al., 2011; Griffiths, 1989). Spiral paths of charged particles occur in a magnetic bottle as a plasma confinement (Serway, 1996; Halliday et al., 2011; Benson, 1996).

Photodetachment of H^- in electric and magnetic fields has been conducted theoretically by several authors, such as in crossed electric and magnetic fields (Peters and Delos, 1993), in crossed electric and magnetic fields near a metal surface (Wang, 2014), in crossed gradient electric and magnetic fields (Wang and Cheng, 2016), and in parallel electric and magnetic fields near metal surface (Tang et.al., 2016) in which classical motion equations of the detached electron are derived from the Hamiltonian governing the electron. Using simpler method, motion equations of a charged particle in uniform crossed electric and magnetic fields are obtained by applying the second Newton's law to the Lorentz force acting on the particle (Khotimah et al., 2017). This work explores the motions of a charged particle within uniform parallel electric and magnetic fields. Analytical formula is derived from a simple method (Khotimah et al., 2017) to obtain the motion equations and the trajectories which are influenced by initial velocity of the particle and the magnitude of electric field.

Theory

In this work, it is considered a charged particle *q* with mass *m* moves with velocity $\vec{v} = \left(v_x\hat{i} + v_y\hat{j} + v_z\hat{k}\right)$ in uniform electric field $\vec{E} = E_z\hat{k}$ and uniform magnetic field $\vec{B} = B_z\hat{k}$ from initial position $\vec{r}_0 = x_0\hat{i} + y_0\hat{j} + z_0\hat{k}$ and initial velocity $\vec{v}_0 = v_{x0}\hat{i} + v_{y0}\hat{j} + v_{z0}\hat{k}$ as shown in Figure 1. The fields affect the particle motion through the Lorentz force $\left(\vec{F}\right)$ (Serway, 1996; Cutnell and Johnson, 2013; Halliday et al., 2011; Benson, 1996; Griffiths, 1989).

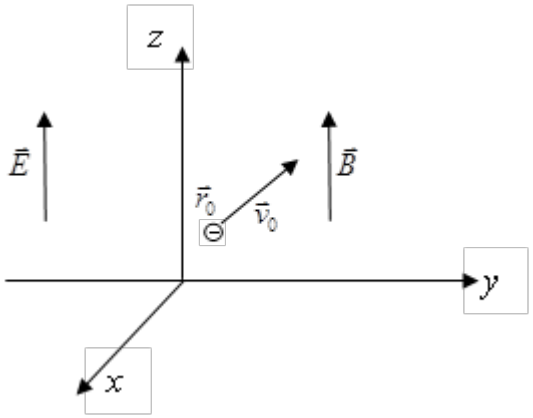

Figure 1. Schematic plot of a charged particle with initial conditions $\vec{r}_0 = x_0\hat{i} + y_0\hat{j} + z_0\hat{k}$ and $\vec{v}_0 = v_{x0}\hat{i} + v_{y0}\hat{j} + v_{z0}\hat{k}$ in uniform parallel magnetic and electric fields along the +z-axis

$$\vec{F} = qE_z\hat{k} + q\left(v_x\hat{i} + v_y\hat{j} + v_z\hat{k}\right)\times B_z\hat{k} \quad (1)$$

Applying the second Newton's law on the charged particle acted by the Lorentz force is

$$m\left(a_x\hat{i} + a_y\hat{j} + a_z\hat{k}\right) = \left(qv_yB_z\right)\hat{i} + \left(-qv_xB_z\right)\hat{j} + \left(qE_z\right)\hat{k} \quad (2)$$

Therefore, three differential equations are obtained.

$$\frac{d^2x}{dt^2} = \omega\frac{dy}{dt}, \qquad \frac{d^2y}{dt^2} = -\omega\frac{dx}{dt}, \qquad \text{and} \quad \frac{d^2z}{dt^2} = \frac{qE_z}{m} \quad (3)$$

ω is the cyclotron frequency, at which the particle would orbit in the absence of electric field (Serway, 1996; Cutnell and Johnson, 2013; Halliday et al., 2011; Benson, 1996; Griffiths, 1989).

$$\omega = \frac{qB_z}{m} \quad (4)$$

The first two of equations (3) are coupled differential equations. By differentiating the first of equations (3) with respect to *t* and using the second equations (3) to eliminate $\frac{d^2y}{dt^2}$, we obtain a linear third order differential equation with constant coefficients,

$$\frac{d^3x}{dt^3} + \omega^2\frac{dx}{dt} = 0$$

The solution for $x(t)$ is obviously obtained.

$$x(t) = C_1\cos\omega t + C_2\sin\omega t + C_3 \quad (5)$$

Inserting solution (5) into the first of equations (3), we obtain $\frac{dy}{dt}$ and then it gives the solution for $y(t)$.

$$y(t) = C_2\cos\omega t - C_1\sin\omega t + C_4 \quad (6)$$

The third of equation (3) is for motion under constant acceleration so that the position of particle in *z*-axis as a function of time is

$$z(t) = C_5 + C_6\,t + \frac{1}{2}\frac{qE_z}{m}t^2 \quad (7)$$

Equations (5), (6), and (7) are a complete set of solutions for particle motion.

The initial condition of the charged particle is specified first. It starts at position $\vec{r}_0 = x_0\hat{i} + y_0\hat{j} + z_0\hat{k}$ and moving with initial velocity $\vec{v}_0 = v_{x0}\hat{i} + v_{y0}\hat{j} + v_{z0}\hat{k}$. These six conditions, i.e. $x(0) = x_0$, $y(0) = y_0$, $z(0) = z_0$, $v_x(0) = v_{x0}$, $v_y(0) = v_{y0}$, and $v_z(0) = v_{z0}$, determine the constants C_1, C_2, C_3, C_4, C_5, and C_6. Thus, the equations of motion for the particle are

$$x(t) = -\frac{v_{y0}}{\omega}\cos\omega t + \frac{v_{x0}}{\omega}\sin\omega t + x_0 + \frac{v_{y0}}{\omega} \tag{8}$$

$$y(t) = \frac{v_{y0}}{\omega}\sin\omega t + \frac{v_{x0}}{\omega}\cos\omega t + y_0 - \frac{v_{x0}}{\omega} \tag{9}$$

$$z(t) = z_0 + v_{z0}\,t + \frac{1}{2}\frac{qE_z}{m}t^2 \tag{10}$$

Equations (8) and (9) are sinusoidal functions and they define the trajectory of the particle in *x*-*y* plane.

$$\left(x - \left(x_0 + \frac{v_{y0}}{\omega}\right)\right)^2 + \left(y(t) - \left(y_0 - \frac{v_{x0}}{\omega}\right)\right)^2 = \left(\frac{v_{x0}}{\omega}\right)^2 + \left(\frac{v_{y0}}{\omega}\right)^2 \tag{11}$$

Equation (11) is a formula for a circle in *x*-*y* plane of radius *R*

$$R = \sqrt{\left(\frac{v_{x0}}{\omega}\right)^2 + \left(\frac{v_{y0}}{\omega}\right)^2} \tag{12}$$

which is centered at point C $\left(\left(x_0 + \frac{v_{y0}}{\omega}\right), \left(y_0 - \frac{v_{x0}}{\omega}\right)\right)$.

Therefore, the general trajectory of the particle is a circular helix with radius *R* and pitch *p*.

$$p = v_z\left(\frac{2\pi m}{|q|B_z}\right) = \left(v_{z0} + \frac{qE_z}{m}t\right)\left(\frac{2\pi m}{|q|B_z}\right) \tag{13}$$

The pitch is along *z*-axis and is a function of time.

Results and Discussion

In this study, an electron ($m = 9.11\times10^{-31}\text{kg}, q = -1.60\times10^{-19}\text{C}$) is used as an example of a charged particle to show the particle motions. The electron moves in uniform magnetic field $\vec{B} = 1.0\times10^{-7}\,\hat{k}\,\text{T}$ and uniform electric field $\vec{E} = -2\times10^{-4}\,\hat{k}\,\text{N/C}$. The magnetic force provides the centripetal acceleration in the *x*-*y* plane and the electric field gives constant acceleration in the *z*-axis. For example, if the electron starts from initial position $\vec{r}_0 = \left(0\hat{i} + 0\,\hat{j} + 6\hat{k}\right)$ m with initial velocity $\vec{v}_0 = \left(5.0\times10^3\,\hat{i} + 5.0\times10^3\,\hat{j} + 2.0\times10^4\hat{k}\right)$ m/s then the equations (4), (8) to (10) give (in SI units):

$$\omega = \frac{qB_z}{m} = -1.76\times10^4 \tag{14}$$

$$x(t) = 0.285\cos\left(1.76\times10^4 t\right) + 0.285\sin\left(1.76\times10^4 t\right) - 0.285 \tag{15}$$

$$y(t) = 0.285\sin\left(1.76\times10^4 t\right) - 0.285\cos\left(1.76\times10^4 t\right) + 0.285 \tag{16}$$

$$z(t) = 6 + 2\times10^4 t + \frac{1}{2}3.51\times10^7 t^2 \tag{17}$$

The trajectory of the particle in *x*-*y* plane and the helical pitch are

$$(x + 0.285)^2 + (y - 0.285)^2 = (0.403)^2 \tag{18}$$

$$p(t) = 7.15 + 1.26\times10^4 t \tag{19}$$

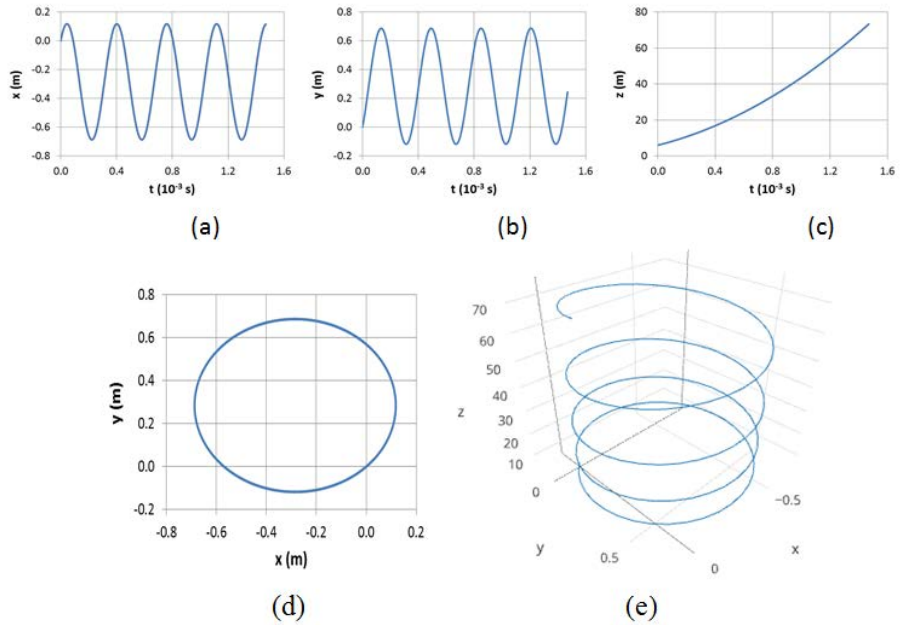

Figure 2. The motion of an electron from $\vec{r}_0 = \left(0\hat{i} + 0\,\hat{j} + 6\hat{k}\right)$m with $\vec{v}_0 = \left(5.0\times10^3\,\hat{i} + 5.0\times10^3\,\hat{j} + 2.0\times10^4\,\hat{k}\right)$m/s in $\vec{B} = 1.0\times10^{-7}\,\hat{k}$ T and $\vec{E} = -2\times10^{-4}\,\hat{k}$ N/C.
(a) *x*-component, (b) *y*-component, (c) *z*-component, (d) *x*-*y* plane, and (e) 3-D space

Figure 2 shows the particle motion in *x*-component, *y*-component, *z*-component, *x*-*y* plane, and circular helix trajectory with its pitch linearly changes with time. It can be seen clearly that the motion in *x*-component (Figure 2(a)) and *y*-component (Figure 2(b)) are sinusoid. According to equation (11), projection of the trajectory in *x*-*y* plane produces a circle with radius *R* of 0.403 m whose center at (–0.285m, 0.285m) as shown in Figure 2(d). The particle motion in *z*-component has a constant acceleration of 3.51×10^7 m/s^2 due to electric force and in this example it starts from z_0 = 6 m as presented in Figure 2(c). The trajectory of the particle is a tenuous circular helix as shown in Figure 2(e).

In this work, the influence of initial velocity $\vec{v}_0 = v_{x0}\,\hat{i} + v_{y0}\,\hat{j} + v_{z0}\hat{k}$ is studied. The *x* and *y*-component of initial velocity (v_{x0} and v_{y0}) influences the radius *R* of the circular helix according to equation (12). Meanwhile, the *z*-component of initial velocity (v_{z0}) influences the direction of helical motion. Figure 3 shows the influence v_{0z} of 2×10^4 m/s, 0, and -2×10^4 m/s in $\vec{v}_0 = \left(5.0\times10^3\,\hat{i} + 5.0\times10^3\,\hat{j} + v_{0z}\hat{k}\right)$ on the trajectory. The trajectories are tenuous helix with their pitch changes with time due to constant acceleration in the *z*-component by the electric field as written in equation (10). The direction of helical movement in Figure 3(c) is initially toward *z*-negative and then finally to the *z*-positive as presented in Figure 3(d).

In the absence of electric field ($\vec{E} = 0$), the motion of the particle is influenced by the magnetic field alone so that the trajectory depends on the initial velocity of the particle as shown in Figure 4. If v_{0z} is constant then the trajectory is a circular helix with constant pitch (Figure 4a). This circular helix has radius *R* of 0.403 m and constant pitch of 7.15m. However, if $v_{0z} = 0$ then the trajectory is a circle in *x*-*y* plane (Figure 4b). The circular trajectory has the same radius *R* of 0.403 m. The center of circular trajectory is at point *C* (–0.285, 0.285, 6) m. This circular motion is usually only characterized by the radius of curvature in many physics textbooks (Serway, 1996; Cutnell and Johnson, 2013; Halliday et al., 2011; Benson, 1996; Griffiths, 1989).

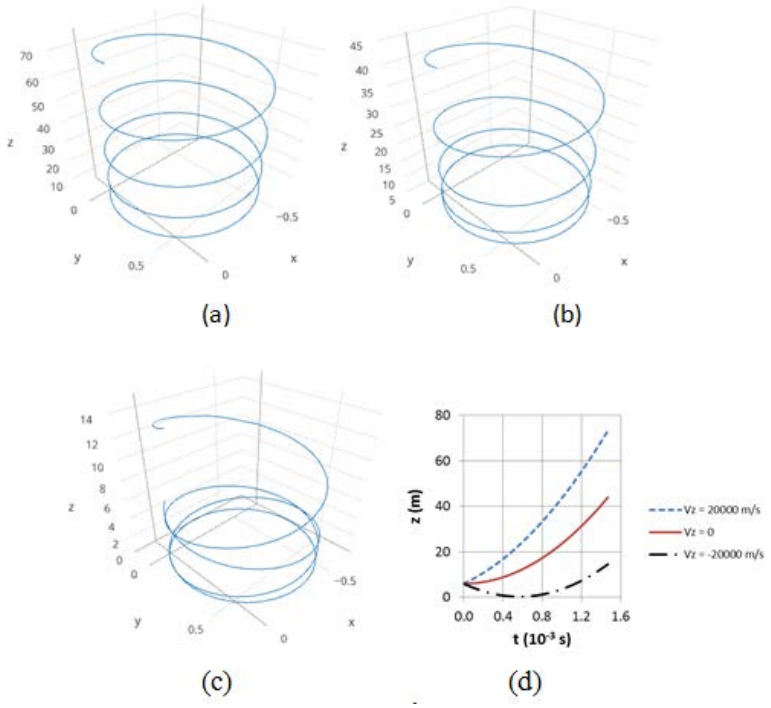

Figure 3. Circular helical trajectories of an electron in $\vec{B} = 1.0\times10^{-7}\,\hat{k}\,\mathrm{T}$ and $\vec{E} = -2\times10^{-4}\,\hat{k}\,\mathrm{N/C}$. It starts from $\vec{r}_0 = \left(0\hat{i} + 0\hat{j} + 6\hat{k}\right)\mathrm{m}$ with $\vec{v}_0 = \left(5.0\times10^3\,\hat{i} + 5.0\times10^3\,\hat{j} + v_{0z}\hat{k}\right)\mathrm{m/s}$: (a) $v_{0z} = 2\times10^4$, (b) $v_{0z} = 0$, (c) $v_{0z} = -2\times10^4$ and (d) the corresponding *z*-component

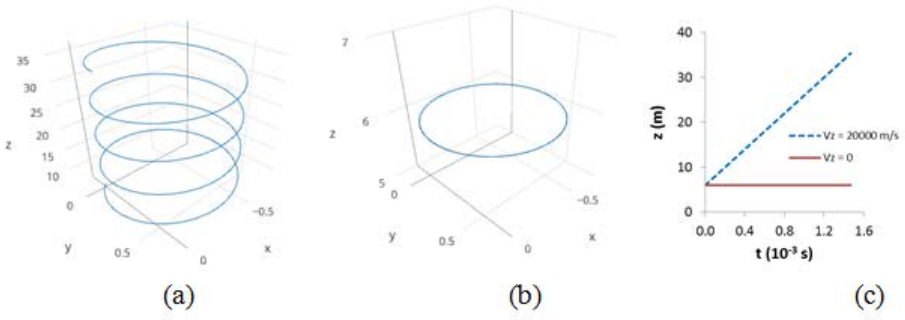

Figure 4. Helical and circular trajectories of an electron in $\vec{B} = 1.0\times10^{-7}\,\hat{k}\,\mathrm{T}$ and $\vec{E} = 0$. It starts from $\vec{r}_0 = \left(0\hat{i} + 0\hat{j} + 6\hat{k}\right)\mathrm{m}$ with $\vec{v}_0 = \left(5.0\times10^3\,\hat{i} + 5.0\times10^3\,\hat{j} + v_{0z}\hat{k}\right)\mathrm{m/s}$: (a) $v_{0z} = 2\times10^4$, (b) $v_{0z} = 0$ and (c) the corresponding *z*-component

The influences of initial velocity on circular trajectory of an electron in *x*-*y* plane starting from initial position $\vec{r}_0 = \left(0\hat{i} + 0\hat{j} + 0\hat{k}\right)$ within $\vec{B} = 1.0\times10^{-7}\,\hat{k}\,\mathrm{T}$ and $\vec{E} = 0$ are shown in Figure 5. The influence of initial speed is shown in Figure 5a by taking four values, i.e. $\vec{v}_0 = n\times2.5\times10^3\,\hat{j}\,\mathrm{m/s};\ n = 1,2,3,4.$ and it shows longer radius of the circular trajectory for greater initial speed with $R = n\times0.142\,\mathrm{m};\ n = 1,2,3,4.$ The influence of initial velocity direction with the same speed is also presented in Figure 5b using initial speed $\left|\vec{v}_0\right| = 5.0\times10^3\,\mathrm{m/s}$ and initial angle $\theta_i = i\dfrac{2\pi}{8};\ \ i = 0,1,2,\ldots7.$ with respect to +*x*–axis which resulted

different positions of the center $C\left(-0.285\sin\left(i\frac{2\pi}{8}\right),0.285\cos\left(i\frac{2\pi}{8}\right),0\right)\text{m}$ $i=0,1,2,..7.$ but with the same radii R = 0.285 m.

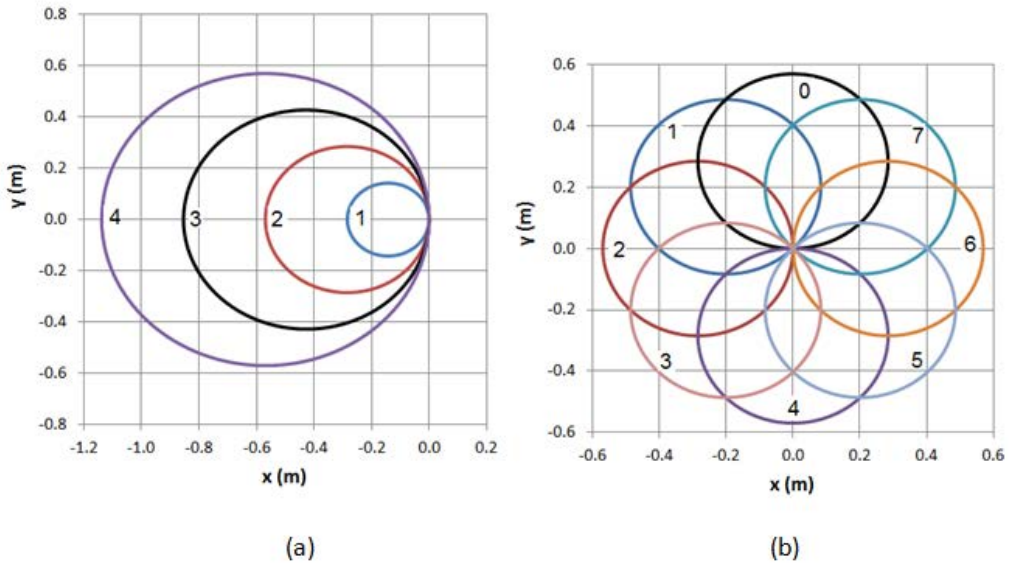

Figure 5. Circular trajectories of an electron in $\vec{B}=1.0\times10^{-7}\,\hat{k}\,\text{T}$ and $\vec{E}=0$.
It starts from origin $\vec{r}_0=\left(0\hat{i}+0\hat{j}+0\hat{k}\right)$ with different initial velocities in *x*-*y* plane:
(a) influence of initial speed $\vec{v}_0=n\times2.5\times10^3\,\hat{j}\,\text{m/s};\ n=1,2,3,4.$
(b) influence of initial direction (angle) using speed $5.0\times10^3\,\text{m/s}:\ \theta_i=i\frac{2\pi}{8};\ i=0,1,2,...7.$

Conclusions

This work has described the possibility trajectories of a charged particle in uniform electric field $\vec{E}=E_z\hat{k}$ parallel to magnetic field $\vec{B}=B_z\hat{k}$ influenced by initial velocity. The trajectory is circular helix with its pitch is a function of time if the particle has velocity component on the *x*-*y* plane ($\vec{v}_0=v_{x0}\hat{i}+v_{y0}\hat{j}+v_{z0}\hat{k}$, $\vec{v}_0=v_{x0}\hat{i}+v_{y0}\hat{j}$, $\vec{v}_0=v_{x0}\hat{i}$ or $\vec{v}_0=v_{y0}\hat{j}$), circular helix with constant pitch if the particle has velocity component in *z*-axis ($\vec{v}_0=v_{x0}\hat{i}+v_{y0}\hat{j}+v_{z0}\hat{k}$, $\vec{v}_0=v_{x0}\hat{i}+v_{z0}\hat{k}$, $\vec{v}_0=v_{y0}\hat{j}+v_{z0}\hat{k}$) and $\vec{E}=0$, and circle if the particle moves only in *x*-*y* plane ($\vec{v}_0=v_{x0}\hat{i}+v_{y0}\hat{j}$, $\vec{v}_0=v_{x0}\hat{i}$, $\vec{v}_0=v_{y0}\hat{j}$) and $\vec{E}=0$. The magnitude of initial velocity influences the radius and the direction of the initial velocity influences position of the center.

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INFORMATION SECURITY EDUCATION: WATCHING YOUR STEPS IN CYBERSPACE

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Abstract: This paper discusses the importance of providing at least a basic education in information security to all users of any information and communication system, regardless of whether they are information technology professionals, students of computer or information sciences, or not. It explores how any person sharing and communicating their information assets with others could be subject to information security threats, and studies certain known cyber-criminals and black-hat hackers, and their cyber-actions and cyber-crimes in order to depict the importance of acquiring an understanding and awareness of information security, so that users of information and communication systems may prepare and strengthen themselves against imminent information security threats.

Keywords: Information Security Education, Awareness, Risk Perception, Cybercrimes, Cybercriminals, Information Security Behavior

Introduction

Information technology (IT) education has become an integral part of education regardless of the subject being taught. Even for professionals and students not working or majoring in computer science or information science related fields, the use of IT may come in multiple forms; sometimes as a tool for delivering the subject matter and assessments such as in learning management systems, presentation slides, etc., and at other times as a tool for creating systems to make practice of that subject convenient and more efficient, i.e. health management systems, online banking applications, and numerous other such subject-specific computer and information technology systems. Thus, basic skills such as basic programming, database development, web interface development, etc. are also studied by most non-computer professionals in order to help them put their knowledge of their specialized subject into practice. A most important concept regarding computer and information science which is often overlooked, however, is information security. Yet, information security is an integral part in any computer system which stores information and allows its users to access and share that information, since a good system should be more about proper and secure sharing and communication of information instead of simply allowing access to available information regardless of whether each user should be allowed access to that information or not. According to Harris and Maymi (2016), the IT industry is growing much faster than people can be educated to properly maintain it, thus leaving less time for IT specialists and security professionals to discover new security practices and procedures and giving more time for hackers to learn how to circumvent these security mechanisms (Harris & Maymi, 2016). Additionally, any user of an information and communication system, whether it be an online banking application containing digitized financial information, a health information system containing both digitized and non-digitized information regarding medical history and so on, or a seemingly simple social networking site which allows the user to share their personal information with other users, should have sufficient knowledge about information security in order to properly utilize the information and communication system they use, while ensuring that their privacy is protected and that the information is only shared and communicated with the proper people through proper channels. Therefore, this paper discusses the importance of information security education not only for students majoring in computer and/or information science, but also for designers, developers and users of any information and communication system.

Importance of Information Security Education and Awareness

A thorough education in information security would have to cover certain basic, yet mandatory, subject areas. These information security subject areas comprise of Access Control Systems and Methodology, where specific users or user roles are identified and access to information is controlled based on user privileges by user authentication and authorization to access, Telecommunications and Network Security, where communication systems, network structures, devices, protocols, remote access, etc. are considered, Security Management Practices, which entail classification of data, policies, procedures, standards, guidelines, risk assessment and

management, personnel security training and awareness, security budget versus needed protection, etc., Application and Systems Development Security, where the way information security is integrated in the software development life cycle is considered, along with change control, application security, development practices and risks, malicious code, etc., Cryptography, which is the art and science of disguising data using symmetric or asymmetric algorithms, hashing, etc., Security Architecture and Models, where operating states of the operating system, kernel functions, memory mapping, security models and architectures are studies, Operations Security, which takes personnel and job functions, training, auditing, resource protection, preventive, detective, corrective and recovery controls, and standards compliance and due care, etc. into consideration, Business Continuity Planning and Disaster Recovery Planning, where resource identification and value assignment is conducted and business impact analysis is performed to enable crisis management, plan development, implementation and maintenance, Security Laws, Investigations and Ethics, where laws, regulations, crimes, software licensing and privacy, evidence types and admissibility into court, incident handling, etc. are considered and how to perform digital forensics while maintaining the chain of custody etc. are studied, and Physical Security, where perimeter security, restricted areas, authorization methods and controls such as biometrics, swipe cards and tokens, pass codes and personal identification numbers, etc., motion detectors, sensors, alarms, intrusion detection and intrusion prevention, fire detection, prevention and suppression, heating, ventilation and air conditioning, fencing, security guards, etc. are considered. Certified Information Systems Security Professional (CISSP) exam defines eight CISSP domains as Security and Risk Management, Asset Security, Security Engineering, Communication and Network Security, Identity and Access Management, Security Assessment and Testing, Security Operations, Software Development Security (Harris & Maymi, 2016), which comprise of the above subject areas.

Even though the concept of information security began with its focus being mainly on technological aspects (Bishop, 2003), the importance of the role played by the human aspect pertaining to information security was recognized during the past two decades (Fernando, 2014), with international standards such as ISO/IEC 270001 (2005), etc. emphasizing why human resource security needs to be taken into consideration when managing information security. In fact, the users of a system are considered as the weakest link in security, and according to Lacey (2009), information security has of late shifted its focus where its role has changed from being technology-oriented to one that is more management-oriented (Lacey, 2009). Companies and organizations dealing with vast amounts of data and information are not the only subjects at risk of information security breaches. Anyone with a computer or any other communication device connected to a network could be subjected to information security threats and attacks. Most present day attacks such as social engineering, spear phishing, or collusion from an insider, etc. require a human component to succeed (Williams, 2011), where people are mostly tricked into revealing confidential information to others. Thus, it is important not only for information security professionals and computer or information science students to be aware of information security, but simply any person using any communication device for any purpose, whether it be professional or personal, needs to be aware of information security threats, vulnerabilities, and basic countermeasures against these threats and vulnerabilities.

The information security subject areas and domains listed above are important for information security professionals to perform risk analysis, identify countermeasures, and implement solid security practices to help protect facility, network, system, and information by efficiently and predictably balancing risk with service (Harris & Maymi, 2016). For most users of information and communication systems, however, a basic information security education on how to protect oneself in cyberspace would suffice. In the present day where everyone is more or less digitally interconnected with each other, being ignorant of information security vulnerabilities and possible threats is not an option. Yet, for most users of information and communication systems, ignorance is bliss. In fact, Schneier (2008) discusses how the human brain perceives security and explains how when one's perception of security diverges from the reality, and the perceived risk is thereby less than or greater than the real risk, the countermeasures implemented in order to avert that security risk also diverge from what is actually necessary (Schneier, 2008). Further, Gonzalez and Sawicka (2002) state that proper perception of risk can help keep risk below the 'accident zone' by maintaining security measures above a certain threshold (Gonzalez & Sawicka, 2002). Thus, it is of utmost importance to properly understand the very real security risk taken by all users when sharing and communicating information in today's world. An interesting approach to this is to study about the adversaries from whom one should protect their information assets. These adversaries, the dark knights of cyberspace, are cyber criminals who perform illegal actions and are called black-hat hackers or crackers, to distinguish them from white-hat or ethical hackers. The approach adopted in this paper to provide an understanding of the very real information security threats to users of information and communication systems, is to study certain practices which were followed by some known black-hat hackers, in order to understand the importance of information security education, where information security vulnerabilities lay, and how to strengthen oneself against information security attacks by taking required countermeasures against such vulnerabilities. The remaining sections of this paper explores practices of certain known hackers in order to educate users of information and communication systems on possible threats, vulnerabilities and countermeasures

that can be taken to minimize these risks.

Certain Notorious Black-Hat Hackers and Their Hacks

This chapter will explore three notorious black-hat hackers who pulled off some of the largest and most incredible hacks of all time. The hacks pulled by these black-hat hackers, their actions in cyberspace, how they were apprehended by the authorities, and the mistakes that led to their capture, etc. will be discussed here. For the remainder of this paper, the term 'hacker' will be used to identify or describe a black-hat hacker or cybercriminal. In this paper, the cyber actions of the hackers Jeanson James Ancheta, Kevin Poulsen, and Albert Gonzalez are studied.

Jeanson James Ancheta

Selecting certain hackers out of the numerous known destructive hackers for this study was difficult, but placing Jeanson James Ancheta within the top-ranked hackers is not surprising as he was the first person to be accused of controlling a large number of hacked computers.

Ancheta was a high school dropout who invented 'rxbot' – a software robot program also known as a bot. Bots or software robots are malicious software created to take over the control of a computer remotely by a third party (Pegg, 2016). With this software, Ancheta took over a large number of computers connected to the Internet under his control. These networks where the computers are connected with malicious bot programs are called botnets. Ancheta used a botnet to send spam and connection requests to online servers by launching spam distributed denial of service (DDoS) attacks. Even though these computers were involved in these sorts of criminal activities, the real owners of these computers would never know what took place. Ancheta started building his botnet in June 2004 and his collection included two military sites as well (FBI, 2006).

After his success in creating a large botnet, Ancheta hosted a website to sell or rent infected computers for other hackers and in this website, he listed guidelines on how to use bots and estimations about how many botnets someone would need to crash a corporate website, etc. The rate he charged for his bots were four cents apiece and a client needed to rent or purchase a minimum of ten thousand bots. According to the Federal Bureau of Investigation (FBI), when they finally caught up with him, Ancheta was successful in conducting business with ten clients. 'SoBe' was a teen from Florida who joined with Ancheta in August 2004 and helped him to grow the number in his botnet up to four-hundred-thousand computers. Using his botnet, he made nearly $60,000 by joining as an affiliate for online advertising. Ancheta got paid every time an owner of a computer in the botnet had to download adware and visited the advertisement. He earned all that money in just under six months (FBI, 2006).

The FBI got the scent of Ancheta after seeing the price list in his website. The FBI nick-named him the 'Zombie King' as the computers he hacked and controlled perfectly matched the concept of zombies. FBI agents got to him by posting in an online chat room asking for Ancheta's help in launching an attack using his bots. In the chat room, he bragged about making a thousand dollars within just two weeks with his botnets and he made a deal with the undercover agents for two-thousand bots. He finalized the deal by saying that two-thousand bots were "enough to drop a site". As a result of this undercover operation, the FBI seized his computer in December 2004 and disabled his server in May 2005. Ancheta was arrested in November 2005 and pleaded guilty to federal charges of hijacking computers for profit. He was the first person to plead guilty to this crime. After the trial, he was sentenced to fifty-seven months in prison followed by supervised release. He was also ordered to make restitution for damages caused to the two military sites which he had added to the computer collection in his nationwide botnet (FBI, 2006).

Kevin Poulsen

Among notorious hackers, the man named as 'the Hannibal Lecter of Computer Crime', Kevin Poulsen is one of the most talked about due to the steep turn he took in his career. Before the nickname given him by the FBI, he was known in the world of hackers as 'Dark Dante'. He can be called one of the luckiest hackers of all time. In 1988, when he was just twenty-three years of age, Poulsen was successful in hacking into a federal computer network. After gaining illegal access, he started to poke around the file regarding the investigation of the president of the Philippines, Ferdinand Marcos. This was the hack that cost him his invisibility over the Internet.

After realizing that the FBI has caught scent of him, Poulsen fled for his freedom. Unlike most outlaws, Poulsen managed to stay untouched for seventeen months. Even during this period of laying-low, he was not the type of person who could keep quiet. He hacked into FBI servers and revealed wiretaps that had been set up for mobsters, foreign politicians, and the American Civil Liberties Union (Lammle, 2011). The hack he was most notorious for is the one he pulled on KIIS FM, a Los Angeles-based radio station, to win a brand-new Porsche 944 S2 and $20,000 in cash (Poulsen, 2017). Poulsen hacked into all the phone lines connected to this radio station and

jammed them so that no one else could call the radio station until he became the 102nd called and won the grand price. To accomplish this feat, Poulsen engaged the help of some of his disciples such as Ronald Austin and Justin Peterson, and got them to work with him (Soylent Communications, 2014).

Poulsen's dance of mischief came to an end after a television show broadcast by NBC network called Unsolved Mysteries caught wind of him and featured an episode based on him and his hacks. This turned out to be the final blow to end the destruction caused by Dark Dante. While the episode was on air, telephone lines opened to get tips from civilians got blocked. It was not difficult for anyone to figure out the cause behind that block. Broadcasting this episode and educating the people in the US about this most-wanted cyber-criminal, led to Poulsen's arrest. Even having been one of the FBI's most wanted criminals, Poulsen could not be prosecuted for any major charges. Prior to his hearing, however, he was incarcerated in a federal facility for five years without bail until the FBI could build a case against him since he was too deeply involved in the national secrets by hacking into classified information, before being released to serve his court sentence (Littman, 1993).

Once having being considered as one of the most-wanted criminals, Poulsen can also be considered the most reformed hacker of all time. After his release, he took a completely different path and went on to become a journalist and a cyber-security consultant. He is also famous for helping to find seven-hundred-and-forty-four sex offenders who were phishing for underage victims using social media such as MySpace (Lammle, 2011).

Albert Gonzalez

There are two main reasons why people explore the darkness of hacking. One reason is the curiosity or the excitement which they get from breaking the law, and the other reason, which is the most addictive reason, is monetary gain. When it comes to cyber-crimes resulting in financial damages, the name Albert Gonzalez is ranked at the top with the largest cyber-crime of all time, even though he eventually had to pay his dues with twenty years in prison, a $25,000 fine, and restitution for the losses caused in the companies which he hacked. Before looking at the prosecution and punishment of Gonzalez, it is required to understand the actual crime he was accused of (Verini, 2010).

Gonzalez was a twelve year-old boy when he bought his first computer out of his own money. One day, while downloading some content, he accidentally downloaded a computer virus and had to call the computer technician to fix the issue. That planted the seed of curiosity about computer security in his mind. This interest that came out of the blue, led to his dive in the advanced science of computer and cyber-security. At age fourteen, Gonzalez was paid a visit by an FBI agent, because he had hacked into the National Aeronautics and Space Administration (NASA) Agency's database. According to Gonzalez's best friend, the person responsible for providing Gonzalez with the packet sniffing tool which he used in his crime was Stephan Watt (Verini, 2010).

Before being the mastermind of the largest cyber-crime of all time, Gonzalez started his career in a smaller scale scam, which was caught by the police in 2003. One night, a detective who was undercover investigating a string of car thefts, accidently noticed a random person who looked a little suspicious. The detective followed him to an automated teller machine (ATM) and pretended to withdraw money from a different ATM while observing the suspicious character. Gonzalez inserted an ATM card and withdrew a few hundred-dollar bills. Instead of stopping after using one card, he pulled out one card after the other. Since it was close to midnight, his plan was to withdraw money from the ATM until the cards reached their limits for that particular day and to use them again once their limits reset after 12:00am. The detective took Gonzalez into custody, and it was not until he was interrogated by the police that they came to know that he was Albert Gonzalez, who was in an administrative position in a website called 'shadowcrew.com', which was one of the black-market sites for illegal products and stolen credit card information. This information made the story of Gonzalez take a new and unexpected turn when the Secret Service came into play (Verini, 2010).

The Secret Service of United Stated was investigating about credit card and identity theft and even had a special task force dedicated to the task. When they got to know that a person associated with 'Shadow Crew' was in custody, they saw a golden opportunity to bring 'Shadow Crew' down. When the proposal to work as a confidential informant for the Secret Service in exchange for his freedom and a salary of $75,000 was offered, Gonzalez accepted the deal without any hesitation. His job was to lure the users of that website to a virtual private network (VPN), claiming that it was a safe channel. This VPN, of course, was wire-tapped by the Secret Service. With the help of Gonzalez, the Secret Service was able to bring down twenty-eight members of 'Shadow Crew' who were involved in dealing stolen credit card information. This mission, which ended in 2008, was code named 'Mission Farewell'.

After that, Gonzalez moved to Miami, but unbeknownst to the Secret Service, while serving his country, he had

also laid out a master plan. While conducting a war-driven expedition along Miami highways and other locations to find poorly protected wireless networks, he also found some well-known retailers. Among them, he spotted a company called TJX. Together with his crew of misfits, Gonzalez connected to the local network of TJX. It was only a matter of time until they made their way up to the corporate network in Massachusetts. Gonzalez now needed a way to get the data from the transactions happening in the network. For that, he turned to his best mate, Stephan Watt, who equipped him with the packet sniffing tool. With that, Gonzalez and his crew could get their hands on all the transaction data from the network including credit card information. He used the SQL Injection technique to extract information from company databases. After retrieving that data, he stored it in two servers he had rented in Ukraine and in Latvia. When he finally got caught, there was information about 16.3 million credit and debit cards stored in the Latvian server, and about twenty-seven-point-five million cards in the server in Ukraine. In order to sell this information, he joined forces with a Ukrainian black-market credit card dealer called Maksym 'Maksik' Yastremskiy. When he received the information from Gonzalez, he would distribute them to other small scale black-market credit and debit card dealers for e-Gold, web money, and even for normal bank transactions in to Eastern European bank accounts. The whistle was blown on their perfect fairytale when Yastremskiy was arrested in Turkey in 2007 from the leads the authorities got about the hack on Dave and Buster's company. In his computers, they found large amounts of data which was linked to the e-mail address 'soupnazi@efnet.ru'. 'Soup Nazi', which was an early nickname used by Gonzalez, gave away the hacker who Yastremskiy was in cohorts with: Albert Gonzalez. This information dropped the final nail on the coffin of Gonzalez's arrest and prosecution, and he was sentenced to the lengthiest punishment ever given to a cyber-criminal, which is 20 years imprisonment, by also taking into consideration his plotting and planning other cyber-crimes even while working as a confidential informant for the Secret Service (Verini, 2010).

Lessons Learned

There are a few lessons that can be learned from studying these hackers and their hacks. First, it can be seen that digitized information can be easily shared and communicated with others, but limiting its access to a select few is a difficult task in today's heavily interconnected world. Thus, unless one is absolutely certain that a certain piece of information needs to be shared they should refrain from sharing it on the Internet or on any network. One should diligently follow best practices in creating passwords, etc., follow proper protocol and procedures when sharing information and refrain from trying to cut corners to make their task at hand easier. Security always comes at a cost, and if a required security standard has been established, then the users of that system should comply with that standard and all it entails. One should refrain from clicking on unnecessary or unfamiliar buttons and links, etc. and if it is required, one should always validate certificates or other credentials before performing such actions.

Further, looking at the reasons why these hackers got caught can also provide guidance on behavior in cyberspace. For instance, Ancheta got caught not due to any technical issue, lack of skill, or a misstep in his hacking methods. Instead, it was his psychological reaction to brag about his achievements, along with publicly marketing his malicious work in order to earn a few extra bucks that led to his destruction. When looking at how Gonzalez got captured, it can once again be seen that his need to sign his work by using his previous nickname in the e-mail address which he used for dealings with other criminals, led to his downfall. In fact, this need for taking credit for their work, making their mark, and the behavior resulting from such psychological acclaim is something common not only to most criminal masterminds, but also to people in general. Thus, it can be seen that watching one's step is more important in cyberspace than advertising one's achievements, whereabouts, and habitual patterns.

Conclusion

In conclusion it can be seen that any user of an information and communication system needs information security education and awareness so that they may know the security risks they are taking, and device a security plan to suit the risk, as well as to be able to safeguard their information assets and protect them from perceived threats. A complete and thorough education in information security covering all security domains will only be required for students of computer or information science, and IT professionals and software engineers who design and develop software programs, applications, and information and communication systems. Yet, any person who uses such a system should have a basic understanding and awareness of information security before publicly publishing their information in any such system or network. Thus, it can be concluded that just as important as it is to give a basic IT skills education to students of many different subject fields and people of many different professions, it is also important – perhaps to even a greater extent – to give them an information security education to provide the basic understanding and awareness of information security. If unable to prevent information security breaches and attacks, this will at least help all users of information and communication systems to at least minimize the damage of such a breach or an attack, and thereby protect the majority of their information assets.

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MACHINE LEARNING APPLICATIONS IN DETECTION OF THE BREAST CANCER: MINI-REVIEW

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Abstract: The early diagnosis of the breast cancer has become imperative in cancer research because it may facilitate the subsequent clinical treatment of patients. Separation of breast cancer patients into normal, low and high groups has become important in bioinformatics and biomedical fields. This has led to an increase in the practice of machine learning (ML) methods for early breast cancer diagnosis in the literature. Machine learning methods have been used to model the diagnosis and treatment of breast cancer. ML methods have been used to detect complex cell characteristics in breast cancer images. (ANN), Bayesian Networks (BNS), Random Forest (RF), Support Vector Machines (SVM), Decision Trees (DT), Linear Discriminant Analysis (LDA), Sammon mapping, Stochastic Neighbor New algorithms have been proposed using various machine learning techniques. Although machine learning techniques for breast cancer have been widely applied and ultimately yielded high classification performances, an appropriate level of validation is required to take these methods into account in daily clinical treatment and practice. In this study, the methods used in algorithms for early diagnosis of breast cancer and the classification ratios are described. In the advanced algorithms, various different features and image data are used. As a result, in this article, ML methods for breast cancer research are increasing. For this reason, published articles have been presented to model the risk of breast cancer.

Keywords: Breast Cancer, Machine Learning, Detection

Introduction

In the world, breast cancer is a rapidly developing disease that is often the cause of death and is more common in developed countries. Breast cancer is a type of cancer that develops rapidly in a very short time, starting from a cell of breast tissue. The most accurate and most important way of fighting with breast cancer is early diagnosis and diagnosis. The earlier the breast cancer can be diagnosed, the more chances the patient can heal. In many countries, the number of women who are sick due to breast cancer and die from late detection of breast cancer is increasing. Breast cancer is one of the most common types of cancer in women and is the second leading cause of death after lung cancer. Early detection of breast cancer reduces mortality by 40% or more (Jemal, 2011). 1 out of every 9 females can get breast cancer after middle age. When we look at the work done, 570,000 women are diagnosed with cancer every year on the earth. Breast cancer patients constitute 31% of this cancer rate. Of these breast cancer patients, 17% died. The frequency of breast cancer in North American and European countries is higher than in other parts of the world (Ferlay, 2007). The cause of breast cancer is still unknown. However, it is estimated that some of the factors are related to breast cancer. These factors include breed, breast tumor tumor, age, menses (menstruation) age, gestational age, menopause gray age, female sex, diet and horn. The risk of having breast cancer in people over 50 years old compared to other age groups is approaching 80%. If a mammal is cancerous, the risk of cancer is 5 times higher on the other mammal. Breast cancer has a slightly higher risk of developing breast cancer in women. The risk of developing breast cancer is 3-4 times higher than that seen before 12 years of age. For example, in a woman who entered the menopause at the age of 57, the risk of breast cancer is about 50% higher than that of a woman who entered the menopause at the age of 43. Do not give birth at the age of 30 or give birth at first, increase risk of breast cancer. 99% of breast cancers occur in males and females. Progesterone and estrogen hormone have been shown to increase the risk of breast cancer by an average of 36% (American Cancer Society, 2009). The risk of breast cancer increases if you are fed poor and overweight. Mothers who give milk to baby for less than 1 year carry more breast cancer risk. Protect your mother from breast cancer. The risk of breast cancer in women receiving radiotherapy in the chest region due to any disease increases the risk (American Cancer Society, 2009). Women in the postmenopausal period, hormone therapy containing estrogen for more than 5 years of continuous use of the breast cancer risk increases conditions. While obesity increases the risk of breast cancer after menopause, it does not have such a risk in the premenopausal period. In these people, even less breast cancer is seen. Another factor that increases breast cancer is that it is fed with foods rich in oil. Taking alcohol is not a proven finding today as it increases the risk of breast cancer. Regular sports have been reported to reduce the risk of breast cancer, especially in brisk walking (Karabulut, 2009). Breast cancer is caused by the cell renewal of the human body and the formation of cells that refuse to die. The cells that lose their lives and die must remain in human conscience without dying and soon begin to divide and eventually cover the entire tissue and thus make the human organism unusable. Breast cancer cells have the qualification to pass to other

organs and prevent other organs from functioning. If breast cancer is not detected early and is not treated, it can result in human death. Early diagnosis and treatment of breast cancer is crucial for reducing mortality rates. In order for the treatment of breast cancer to be easy, it needs to be diagnosed early. The early detection of breast cancer increases the chance of rescuing the patient from death. However, early detection of cancer may provide better treatment. Early detection, however, also requires accurate and reliable diagnosis (Turusbekova, 2012), which can differentiate between benign and malignant tumors. In many countries around the world, the Ministry of Health places emphasis on the early detection of breast cancer. If breast cancer is detected early before spreading, the patient has a 96% chance of survival. Every year in the world, 44,000 women die from breast cancer. Therefore, any breast mass that is noticed in the mammary should be evaluated in terms of breast cancer and the possibility of cancer should be determined definitively. This possibility may increase the chances of the patient having breast cancer during treatment (Aytaç Korkmaz, 2015). There are many studies on machine learning techniques on other types of cancer besides breast cancer in the literature (Korkmaz and Binol, 2017), (Korkmaz, S. A., Bínol, H., Akçiçek, A., and Korkmaz, M. F. 2017), (Korkmaz, S. A., Akçiçek, A., Bínol, H., and Korkmaz, M. F., 2017), (Korkmaz, 2018), (Korkmaz, S. A. and Esmeray, F. 2018), (Korkmaz, 2018). Machine learning techniques have also been used to classify more diverse data analyzes (KORKMAZ, 2017), (Korkmaz and Poyraz 2016). But, we will examine computer-aided studies of breast cancer in this article. In Literature, there are computer assisted studies in machine learning techniques in breast cancer diagnosis.

Related Work

Many studies in the literature have been reviewed for early diagnosis of breast cancer. According to these studies; In article (Korkmaz, 2015), light microscopy was used for early diagnosis of breast cancer. 180 images were obtained with light microscope. 23 features are calculated for 180 images. These images were rotated at 4 different angles and a 23x4 feature value was calculated for each 180 images. Minimum Redundancy Maximum Relavance method is used to reduce the size of the properties. Least Square Support Vector Machine method was used as classifier. Images were classified as normal, benign and malignant. Classification success rate is 100%.

In article (Korkmaz and Poyraz, 2014), normal, benign, and malignant histopathology cell images of breast cancer were used. In this article, these images were used to contribute to the early diagnosis of breast cancer. Discrete Wavelet Transform families were applied to breast cancer images. 16 Discrete Wavelet Transform families and 16 feature vectors are obtained. Jensen Shannon, Hellinger, Triangle classifiers were used as classifier. The average classification rate for Jensen Shannon classifier for 16 feature vectors was found to be 97.81%. It was found 97.75% with Hellinger Classifier. It was 97.87% with Triangle classifier. Then the averages of these classification ratios were taken. The classification success rate was 97.81% according to this average ratio.

In article (Korkmaz, S. A., Korkmaz, M. F., and Poyraz, 2016), both mammograms and histopathology images of the same patients were taken to be able to contribute to the early diagnosis of breast cancer. 150 mammograms were obtained from the radiology department of Fırat University Medical Faculty and 150 histopathology images from Fırat University Medical Faculty Pathology Department. These images have Gray level co-occurrence matrix (GLCM) properties. The dimensions of these features have been reduced by the method of minimum redundancy and maximum relevance. 10 properties were obtained. Suspicious probability values of selected properties were obtained with the help of exponential curve. These probabilistic values are used in weight calculations.Calculated weights are used in the Jensen Shannon, Triangle, and Hellinger classifiers. The classification ratios were analyzed by ROC curve. According to this; the highest classification success rate was found with the Jensen Shannon classifier. The accuracy rates obtained with the Jensen Shannon classifier are 99% for histopathology images and 98% for mammography images.

In article (Korkmaz, S. A and Korkmaz, M. F. 2015), mammographic images obtained from the Digital Database for Screening Mammography (DDSM) database were used to be useful for early detection of breast cancer. Some features of the 3x126 view from this database were found. The dimensions of these properties are reduced by the minimum-Redundancy-Maximal-Relevance m (RMR) method. These images were then classified as normal, benign, and malignant with the Kullback-Leibler (KL) classifier using these acquired features for the 3x126 image. An approximate performance estimate was made with the ROC curve. This performance estimate was found to be 98.3%.

In article (Korkmaz, S. A. and Eren, H. 2013), found probabilistic values of suspicious lesions with the aid of exponential curve fitting of 3x10-image from the DDSM database in order to benefit early detection of breast cancer. These probabilistic values were used to find the weight value for analysis with the Kullback Leibler

classifiers. After finding the weight values, the mammographic images were classified as normal, benign, and malign with the kulback leibler classifier.

In article (Korkmaz, 2016), Atomic force microscopy images were used to identify early breast cancer lesions. Breast cancer pathology cells were visualized from atomic force microscope. For this process, atomic force microscopy was used in the nanotechnology laboratory in the physics department of Fırat University. 23 Gray level co-occurrence matrix (GLCM) properties of nanobiomechanical images obtained in this article were obtained. These 23 property values are obtained for 4 different angle values of the images. Thus, a total of 92 feature values were obtained. 92 property values have been reduced to lower dimensions with Minimum Redundancy Maximum Relevance (MRMR) and Principal Component Analysis (PCA) methods.Classifiers such as Least Square Support Vector Machine (LSSVM), Maximums of Statistical Values (MSMMR), and fuzzy k-nearest neighbor (KNN) classifiers are used. The lowest classification rate was 75.56% with PCA_KNN. The highest classification rate is 100% with mRMR_LSSVM, mRMR_KNN methods.

In article (Korkmaz, 2015), developed a computer-aided study for the early detection of breast cancer. Both light microscope images and mammography images were used for this study. For this study, 23 feature values were obtained. By rotating these images at different angles, 92 feature values were obtained for both microscope and mammography views. This work was carried out in 2 steps. In the first step, the 92 property values obtained are reduced to a smaller size with minimum redundancy and maximum relevance (mRMR). In the second step, these optimum properties are classified by Least Square Support Vector Machine (LSSVM) and fuzzy k-nearest neighbor (KNN). It has been suggested that when combined with mammography images and microscope images, that some patients have higher classification success rates when mammograms and microscope images are analyzed at the same time.

Wolfe examined the relationship between breast tissue and breast cancer and reported that the breast parenchyma was divided into 4 groups (Wolfe, J.N., 1976).

In 2006, Cheng, Shi, Min, Hu, Cai and Du using textual features for mammogram images, it was aimed to identify and classify the kits by rotating images at different angles using the gray level co-occurrence matrix. 100% accuracy was found with Roc curves (Cheng, H., Shi, H., Min, R., Hu, L., Cai, X., Du, H., 2006).

In another article, using the Weka program and Data Mining Methods, Breast Cancer Cells were estimated and diagnosed. In this study, decision tree algorithm is applied in malign and benign mass classification process.
The C4.5 decision tree from data mining methods contributed to the early diagnosis of an important disease such as breast cancer with an accuracy of 97.43% in disease diagnosis and diagnosis (Danacı, M., Çelik, M., Akkaya, A.E., 2009).

In one article, the screening of breast cancer is addressed. For this purpose, since the support vector machine known in the world does not give good results, this probing adaptive support vector machine and the composition of Fuzzy C-means algorithm are used. In this study, the United States of Wisconsin State Breast Cancer Database was used. In this study, the accuracy of classification was analyzed according to sensitivity, specificity, positive and negative values. Classification accuracy was 99.87% (Palanivel J., Kumaravel N., 2011).

Zwiggelaar segments the mammograms according to their intensity using re-appearance matrices. For the density classification, the shape features of the density region, such as the size, have been used (Zwiggelaar, R., Blot, L., Raba, D. and Denton, E.R.E., 2003).

In another article, they applied the Fuzzy-Genetic Algorithm method for the diagnosis of breast cancer and the classification accuracy was 97.36% (Pena-Reyes C. A., and Sipper M., 1999).

In another article, artificial neural networks were used to diagnose breast cancer, with an accuracy of 98.10% (Setiono R., 2000).

In the article published in 2008, the diagnosis of the breast cancer cell was made only with images taken from the atomic force microscope. According to the results obtained, a malignant breast cell is softer than a benign breast cell, resulting in a benign cell being stiffer than a malignant cell (Li, Q.S., Lee, G.Y.H., Ong, C.N., Lim, C.T., 2008).

In another article published in 2010, biomechanical and biochemical properties of microspectroscopy and atomic force microscopy were investigated (Yangzhe, W., et al., 2010).

In another article, microspectroscopy and atomic force microscope images were looked at and the diagnostic result was combined to determine the topography and nanomechanics of lung cancer and breast cancer cells (Gerald, D., McEwen, Y., Wu, M., Tang, X., Qi, Z., Xiao, S., M.Baker, T., Yu, T. A., Gilbertson, D., DeWald, B., Zhou, A., 2000), (McEwen, G. D., Wu, Y., Tang, M., Qi, X., Xiao, Z., Baker, S. M., ... & Zhou, A., 2013)

In another article, for mammography images, artificial neural networks were used for the early detection of breast cancer and the accuracy was found to be 98.10% (Setiono, R., 2000).

In another model, 98.53% accuracy was achieved using the support vector method (Polat, K., and Gunes, S., 2007).

In another article, 99.51% correct results were obtained using the support vector machine and feature selection technique (Akay, M.F., 2009).

In a study conducted in 2011, the problem of classification of breast masses was addressed and it was suggested that the method achieved 84.6% success rate (Fraschini M., 2011).

In another study, Neural Network Algortum was used for the breast mass classification process. According to the results obtained, the k-means method was 86.6%, the ANFIS-based SOFM algorithm was 86.2%, and the ANFIS-based learning method (BP) had 91% success rate (In-sung, J., Devinder, T., and Wang, G.N., 2009).

Mencattini used 13 Haralic tissue attributes extracted from images reinforced for classification due to the diagnosis of breast cancer (Mencattini, A., Rabottino, G., Salmeri, M., Caselli, F. and Lojacono, R., 2008).

Brake, Karssemeijer and Hendriks have proposed a method to distinguish malignant tissue from normal tissues in digital mammograms. In this article, a pixel-level method is used to identify spikes and masses. For each speckle there are 2 masses and 5 spe- cies related to 3 speckles (Brake, G.M., Karssemeijer, N. and Hendriks, J.H.C.L., 2000).

Sheshadri and Kandaswamy have attempted to determine whether the mammal is normal, benign, and malignant using mean, standard deviation, smoothness, third moment, uniformity, and entropy attributes (Sheshadri, H.S. and Kandaswamy, A., 2006).

Petroudi and Brady have attempted to differentiate breast types using frame-level matching in another study. Geometric and topographic structures of the images are investigated with this method (Petroudi, S., Kadir, T. and Brady, M., 2003).

Groshong and Kegelmayer used Hough transformations to find the masses in mammogram images (Groshong, B.R. and Kegelmeyer, W.P., 1976).

Li and colleagues used Markov Random fields for mass detection (Li, H.D., Kallergi, M., Clarke, L.P., Jain, V.K. and Clark, R.A., 1995).

Lefebvre et al. Used the fractal approach in segmentation of microcalcifications (Lefebvre, F., Benali, H., Gilles, R., Kahn, E. and Di Paola, R., 1995).

Petrick and colleagues used contrast-enhanced filters based on density of images (Patrick, N., Chan, H.P., Sahiner, B. and Wei, D.,1996).

Li and colleagues, in another study, utilized contextual segmentation and morphological healing methods (H. Li, H. Wang, Y., Liu, K.J.R., Lo, S.C.B. and Freedman, M.T.,2001).

Ertaş and Gülçür have established a relative processing capability curve (ROC) to determine whether the whole mammographic image is intense, the Youden criterion is calculated and the optimum asymmetry value is found (Ertaş, G. ve Gülçür, H.Ö.,2001).

Zhang and colleagues used genetic algorithms to extract features (Zhang, P., Verma, B. and Kumar, K.,2005).

Arnoldi and colleagues conducted a screening of breast cancer cells from AFM images. Here, the elasticity and force diagrams of the cancerous cell were taken with AFM microscope, and the elasticity of the cancerous cell was found to be less than that of benign cells (Arnoldi, M., Kacher, C.M., Bauerlein, E., Radmacher, M., Fritz, M.,1998).

Petushi and colleagues, histopathology, using normal, benign, malign images, have used the microstructural features of these images. In the feature selection, Linear Discriminant Analysis (LDA) and Forward / Backward search methods are used. As a classifier, linear, quadratic, neural network, decision tree is used. The most accurate classification gave a quadratic classifier. The accuracy of the quadratic classifier was found to be 95.6% (Petushi S et al.,2006).

Conclusions

In the world, breast cancer is a rapidly developing disease that is often the cause of death and is more common in developed countries. Breast cancer is a type of cancer that develops rapidly in a very short time, starting from a cell of breast tissue. The most accurate and most important way of fighting with breast cancer is early diagnosis and diagnosis. The earlier the breast cancer can be diagnosed, the more chances the patient can heal. The early diagnosis of the breast cancer has become imperative in cancer research because it may facilitate the subsequent clinical treatment of patients. Separation of breast cancer patients into normal, low and high groups has become important in bioinformatics and biomedical fields. This has led to an increase in the practice of machine learning (ML) methods for early breast cancer diagnosis in the literature. Machine learning methods have been used to model the diagnosis and treatment of breast cancer. ML methods have been used to detect complex cell characteristics in breast cancer images. (ANN), Bayesian Networks (BNS), Random Forest (RF), Support Vector Machines (SVM), Decision Trees (DT), Linear Discriminant Analysis (LDA), Sammon mapping, Stochastic Neighbor New algorithms have been proposed using various machine learning techniques. Although machine learning techniques for breast cancer have been widely applied and ultimately yielded high classification performances, an appropriate level of validation is required to take these methods into account in daily clinical treatment and practice. In this study, the methods used in algorithms for early diagnosis of breast cancer and the classification ratios are described. In the advanced algorithms, various different features and image data are used. As a result, in this article, ML methods for breast cancer research are increasing. For this reason, published articles have been presented to model the risk of breast cancer.

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OUTSIDE THE BOX: CHANGE – VARIOUS FORMS OF CONNECTING PRACTITIONERS IN THE PROCESS OF INTENSIVE KINDERGARTEN DEVELOPMENT

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Abstract: This article describes the characteristics of the traditional, outdated educational practice in the early education institution followed by the ways in which a good quality, modern practice can evolve, as well as the achievements accomplished in some of our institutions. These achievements, as well as the processes that lie within them, are termed *Outside the box*. It is emphasized how the quality of the education development in an early and preschool institution is more concerned with the process than the result (especially not the permanent result), that is, it presents a developmental rather than a static category. In this sense, action research is highlighted as a particularly valuable "tool" for the development of educational practices and curriculum of early education. Action research enables the creation of a community of critical, self-reflective actors who can change the practice on a much wider scale then the individual, and gradually create a new, more human, and more democratic educational policy. The ultimate consequences of action research should be viewed in a much broader context than merely as a means of improving educational practice of certain institutions, that is, as creating a *professional learning community* whose participants connect and support each other in a continuous learning and professional development by strengthening their autonomy and emancipation.

There is a description of various forms of connecting practitioners who show interest and motivation for the introduction of new forms of work in order to provide each other with professional and emotional support. The Facebook group *Outside the Box* is mentioned as a form of linking practitioners for the purpose of discussion and exchange of professional experience and expertise, to which the next subchapter is devoted. This Facebook group was created with the intention of bringing together practitioners involved in the process of intensive kindergarten development through action research so as to enable an exchange of important information, research experiences, and insights which they gained in the process of developing practices. However, a growing number of interested practitioners from many different kindergartens gradually joined this group reaching a total number of 4,200 practitioners from different Croatian cities, as well as from Serbia, Bosnia and Herzegovina, Slovenia, the USA, Finland, Norway, and Australia.
Keywords; Action research, Facebook group, Kindergarten, *Outside the box*

Introduction

Outside the box illustrates the Croatian concept of connecting theoreticians and practitioners of early education on the path to seeking new opportunities for development of early childhood education and early education curriculum. It began as an attempt by the theorists at the Faculty of Humanities and Social Studies, University of Zagreb and two hundred associates from about ten Croatian kindergartens to explore and shape the educational practice so that it would be in line with contemporary pedagogical requirements stipulated in the Croatian National Curriculum for Early and Preschool Education that entered into force in 2015. This document created the legal preconditions for the development of institutional education based on the plurality of pedagogical ideas and concepts whose backbone represents humanistic ideas and developmentally appropriate practices. However, domestic and world experiences testify to the fact that a new official document, even when it is based on very contemporary professional and scientific grounds, has very modest impact on the educational practice itself. The reason for this is that the traditional understanding of the child and childhood, as well as the traditional organization of the educational process that emerges from such an understanding, cannot easily and simply be abandoned or achieved through administrative procedures. Of the many traditionalisms that can be found in the practice of Croatian kindergartens, we will list only a few:

- practice of strict planning and management of children's activities in the educational institution
- practice of direct teaching of children with the content which they need to memorize and reproduce, and which is therefore easily measurable
- practice of parceling children's educational activities according to methodical areas and strictly defined time sequences (so-called "guided activities")
- encouraging one-sided and one-dimensional thinking of children (supporting the expected response of children in joint activities with the preschool teachers) and

• a universal and unified educational approach (the criterion for chosing educational content is the chronological age of children rather than their personal and developmental characteristics or subjective preferences and needs).

Retaining these (and many other) traditionalism in the educational practice testifies to the fact that it is in fact not managed by "official concepts" even when it is prescribed by the state, i.e. the competent Ministry, but rather by the "personal concepts" of practitioners who are employees in the institution.

Action research

With this in mind, we conducted an action participatory research in about ten kindergartens so as to familiarize ourselves with and develop the educational practice and curriculum, as well as to provide support to those practitioners who want to step "outside the box." In this process, our scientific-research activities included several directions.

The first of these was the development of the practitioners' awareness that the quality of life, i.e. the education of the child, determines the entire context of his or her life inside the kindergarten. The context of a child's life within a kindergarten institution is a complex interaction of various structural and cultural dimensions of the kindergarten, since the kindergarten is a complex living system or "a living organism" (Rinaldi, 2006). It is a pulsating, changeable, and interconnected world of rapid interaction in which the order originates naturally from chaos without the necessity of supervision (Roberts and Kleiner, 2003). Because of this, its functioning, i.e. the processes that occur in it, cannot be fully predicted or controlled. On the contrary, the modern educational process, i.e. the resulting curriculum, resembles "a forecast of possibilities within an arena of opportunities" (Rinaldi, according to Male, 2012). It resembles a journey to new and unknown places that change the child's experience (Kalantzis et al, 2003). Such an understanding of the educational process is also the foundation of the development of an open development curriculum (Edwards et al., 1998, Slunjski, 2011). In that sense, the first direction of our "***outside the box***" journey was to develop the practitioners' awareness about the unpredictability of the educational process and to provide support to the development of an open development curriculum.

The second direction involved abandoning the divisions of the educational process into activities aimed at stimulating specific aspects of child development (physical, emotional, social, intellectual, moral, creative, etc.) through separate activities. Instead, it was attempted to help the practitioners to create a wholesome understanding of the processes of nurturing, educating, and teaching children throughout every segment of the educational process. Also, efforts were made to empower them to abandon the idea of partitioning the process of teaching children into areas that, when it comes to school, belonged to certain subjects (Croatian, Mathematics, Science, etc.). This direction of work with practitioners was based on the inauguration of contemporary understanding of children's learning (Petrović-Sočo, 2007; Tarini, 2008; White, 2008; Miljak, 2009), which emphasizes that the quality of children's learning corresponds to the quality of their everyday life in the kindergarten, i.e. that it is not limited to parceled-out and segmented teaching of children according to certain contents. At the same time, these concepts were the foundation for the development of an integrated curriculum that takes into account all areas of the child's development in a uniform manner, which would fit the nature of the child and his or her learning (Bredekamp, 1996). In that sense, "***outside the box***" refers to the development of a holistic understanding of the educational process as the basis for designing a curriculum that has integrated characteristics.

The third direction of our activity referred to abandoning traditional education that is characterized by understanding knowledge as something static, which can be transmitted to children in predictable ways. Instead, it was attempted to promote the idea of creating, i.e. constructing knowledge, which in itself represents a personal, subjective, and authentic construction by the person who learns (Malaguzzi, 1998, Bascia and Hargreaves, 2000, Vygotsky, according to Berk and Winsler, 1995). The way in which a child constructs his or her knowledge depends on his or her prediction and many other individual distinctions, the way in which he or she interprets a particular learning experience and the contextual characteristics in which that learning takes place. The correct way of teaching younger children is not by means of a lecture or a verbal lesson (Bredekamp, 1996), since younger children learn to participate actively, i.e. by creating and collaborating with others (Bredekamp, 1996, Rinaldi, 2006, Penn, 2008). The understanding of knowledge as a dynamic and developmental category that is continually evolving, constructing, and reconstructing is the foundation for the

development of a constructivist, i.e. a co-constructivist curriculum (Miljak, 2007, Slunjski, 2006, 2015, Rinaldi, 2006, Malaguzzi, 1998), and is also the third direction of our "***outside the box***" journey.

The fourth direction of our research focused on examining the existing practice in terms of promoting autonomy and emancipation of children as opposed to child manipulation in the organization of the educational process. Our activities in this part of research focused most on overcoming the traditional position of the child in the kindergarten, which is passive, receptive, and in many respects disempowered. Rather, we have endeavored to strengthen the preschool teachers to encourage independent and critical thinking in children, i.e. to encourage their autonomy as a prerequisite for responsible behavioral development. The reason for this is that an important goal of education is to create autonomous, i.e. respectful relationships that allow children to evaluate things from different perspectives and learn to act independently. In an educational process aimed at respecting the rights and individual freedoms of the child, it is possible to expect the development of those qualities that are necessary for a free, actively creative, and responsible life of the child. This requires a respectful and equal relationship between all participants in the educational process and it focuses on the development of the personality of the child with an emphasis on self-reliance. This understanding of the educational process and the repositioning of the child in it represented the underpinning of the development of a humanist-oriented curriculum (Stenhouse, 1975, Malaguzzi, 1998). This was the fourth direction of our attempt to establish "***outside the box***" practices, i.e. converting the kindergarten into a place where children are not obedient objects but rather equal participants in the process of mutual learning with other children and adults.

Throughout the entire research we observed a noticeable increase in the interest of a larger number of practitioners for the direction in which the educational practice is being developed as well as for the accomplishments that are being achieved. In this respect, they began to express their interest in an active engagement in this process. So we started looking for opportunities for a greater number of connections between the practitioners and for building strong learning communities that would enhance their motivation and further boost their professional learning. We considered this to be important because we have repeatedly assured that achieving good practice does not mean one-time fixing of problems that prevent its development or make it more difficult to develop than to provide the preschool teachers with the tools to continuously recognize and remove problems. In that respect, we have tried to encourage the connection of practitioners since we are convinced that they can change the practice to a much greater scale than the individual, i.e. they can gradually create a new, more humane and more democratic educational policy. In this context, the general direction of our research, which we have painted metaphorically as "outside the box," was to encourage the preschool teachers to move from a lack of freedom and restraint toward freedom, autonomy, equality, co-operation, and promotion of democracy.

Facebook group «Outside the box»

Over time, the number of practitioners involved in direct and many indirect ways of the research process and improvement of educational practices and curricula grew. In this regard, as a particularly innovative form of connecting preschool teachers and other professional kindergarten teachers, it is important to highlight the Facebook group "***Outside the Box***." This group was actually created with the aim of gathering practitioners who participate in intensive career development processes through action research, which enable them to exchange important information, their research experiences, and the insights they have gained in the process of developing the practice. Most of these experiences and insights are described in the research *Outside the Box* from 2015 and *Outside the Box 2: Change* from 2016 (Slunjski, 2015, 2016). Thus, the Facebook group gradually included an increasing number of practitioners from many different kindergartens, so that the total number of its members reached 4,900. In addition to members from the Republic of Croatia, colleagues from Serbia, Montenegro, Bosnia and Herzegovina, Slovenia, and even some from the USA, Finland, Norway, the Netherlands, and Australia jointed the group as well.

Although this is a completely unconventional form of connecting practitioners based on their common interest, this being the development of educational practices and the curriculum of kindergartens, it can still be stated that it provides a certain form of their professional learning. Especially considering the fact that the number of opportunities for participation of preschool teachers of different kindergartens in the Republic of Croatia in an organized professional training program is very small, and in particular in those programs that have

a lasting character, which enables them to discuss everyday problems arising from their practice and which are organized to develop their research and reflexive competences.

Conclusion

The potential for professional development of practitioners through Facebook groups is considerably weaker than through direct contact that is intended for a common analysis of the existing practice and development of better practices. However, practitioners in this group could strengthen their motivation and have the opportunity to somehow sense the "pulse" of kindergartens with high-developed practice and, as far as possible, be "infected" with ideas that characterize the contemporary curriculum.

At the same time, this group also showed that the current level of kindergarten development in the Republic of Croatia is very different, just as the level of professional development of individual practitioners within those kindergarten is very different since preschool teachers understand and interpret the notion of quality of educational practice and curriculum very differently as well as perceive and interpret the problems that arise on the path of this development differently, not to mention that the problems in different kindergartens also greatly differ. But most members of the group share a common acceptance of the idea of joint and collaborative learning that can lead to the release of personal and institutional constraints that reduce the possibility of practicing legitimate human and democratic values.

That is why the ultimate consequence of the research that we undertook is much broader than the improvement of the educational curriculum and the kindergarten curriculum that were directly involved in it. Much greater contribution is seen in building the capacity of individuals and institutions, and creating a professional learning community (Leithwood et al., 2009) whose participants connect and support each other in continuous learning and professional development based on strengthening their autonomy and emancipation. Or, in other words, the empowerment of practitioners to actively, i.e. thoughtfully collaboratively join the idea of developing an "outside the box" practice that needs to be better, more humane, and more democratic.

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RESEARCH ON RECASTS AS ORAL NEGATIVE FEEDBACK: A REVIEW

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Abstract: English language teachers are constantly facing decision making regarding negative feedback (NF); hence, they need to have access to sound research. However, teachers usually have little time for performing extensive literature reviews to make those decisions. Among the choices for NF are recasts which have been shown to be very frequently used, but: how much do teachers know about it? Aim: to present the state of the art of oral recast study literature for language teaching practitioners 'critical appraisal and posterior decision making in the language classroom. It was a documental research in the modality of systematic literature review. The search was carefully conducted under specific search criteria. Articles were filtered by date (finals of 20th century and first two decades of the 21st) and design (descriptive and experimental/quasiexperimental). Two main categories arose during the review. Controversial findings were observed when reviewing studies regarding recasts effectiveness. Some gaps are still observed in the recast study arena. Research on recast effectiveness is still controversial. Even though there is a trend of researchers claiming that recasts are not effective and hence not recommended for the language learning situation, it is still a fertile soil for researchers.
Key words: recast, oral negative feedback, EFL/ESL classroom.

Introduction

Negative Feedback is a field of interest for researchers and teachers because of its influence on language learning. In the literature it has been said that the selection of the negative feedback (NF) is not that simple and authors agree that there is not a NF type that suits all learners in all language teaching settings. Perdomo (2016) claims that difficulties to select the way to correct include the fact that factors like students proficiency, teaching focus and students' cognitive and affective variables need to be considered as groups and as individuals. Among the different options that have been widely studied recasts appear to be very popular as well as controversial.

Recast definition has slightly varied across time. It started from being seen as a 'repetition with change' (Chaudron, 1997) and a decade later it was presented as to is seen as learner's utterance minus the error(s) by Lyster and Ranta (1997). Later, it was constantly modified and about ten years ago a recast was seen as the teacher's partial or total reformulation of a student's utterance that contains at least one error within the context of a communicative activity in the language classroom (Sheen, 2006, p. 365), but the most recent modification for this definition has relied on adding that recast is an attempt to imitate the way real-life correction happens (Mousavi & Behjat, 2014). In sum, although recast has always been seen as implicit feedback, its conception has been widened by researchers as they have gone deeper in recast study. Also different kinds of recast have been identified after several years of research (Perdomo, forthcoming).

Recast has been reported as one of the most commonly used NF in the context of ESL/EFL for decades (Lyster & Ranta, 1997; Panova & Lyster, 2002 and Sheen, 2006). Nevertheless, there are two main trends found in the literature regarding recast: those on behalf (e.g., Goo & Mackey, 2003) and those who have built a case against it arguing lack of effectiveness in the EFL/ESL context (e.g., Lyster & Ranta, 2013). Teachers should not just choose a trend a first sight or by hazard; they are expected to perform a critical appraisal of the literature to choose the appropriate NF according to their context. Hence, the present paper aims to show the state of the art of recast study literature through a careful review of oral recast literature; it is expected to be helpful for language teaching practitioners to form a critical judgment of the issue and as posterior decision making in the language classroom as well as to show the gaps to continue researching. It is not intended to say that the present research shows all what has been published on recast but to show a sample of the sets, variables and approaches for the study of that particular NF. The selection of publications offered might be useful for teachers and researchers to make more appropriate decisions in analogous teaching contexts and to continue doing some research on the issue.

Methods

It was conducted a research under a documental design in the modality of systematic literature review which let the researcher to be able to get a general view of scientific production on recast as oral NF. The search was conducted in academic databases (ERIC and BASE) and different international online and printed peer reviewed journals to find the articles; those journals were on the field of linguistics and language teaching.

The selection criteria established that articles should be filtered by language (English only), date (finals of 20th century and first two decades of the 21st one) and design (just quantitative studies with descriptive and experimental/quasiexperimental designs). Keywords used included: 'oralrecast+effectiveness', 'recast+ESL', 'recast+EFL', 'recast+negative+feedback', 'oral+negative+feedback', among other. Articles including on their metainformation (title and key words) combinations like 'negative feedback', 'recasts', 'implicit feedback', and 'corrective feedback' were selected; then, the researcher read the abstracts to verify that they were related to the topic (recast as oral negative feedback in the foreign/second language classroom). Later a full reading of the article was performed before classifying them.

Analysis was qualitative. Articles were divided into descriptive and experimental/quasiexperimental to finally offer a chronological view of research on the topic so that the reader can notice the more explored issues and the gaps still remaining.

Results

Two main categories arose when classifying the articles dealing with recast as oral negative feedback, namely: descriptive and experimental/quasi-experimental studies. The aforementioned categories are the framework for the findings of those studies.

Descriptive studies

Among the descriptive studies regarding recast are those related to the description of recast effectiveness in a variety of language teaching contexts and those studying other variables related to recast as NF. Even when some authors had stated a point against recasts effectiveness, other decided to keep on studying it (which is justified due to the fact that recasts are very common in the language learning context) and new ways to approach the study of this NF also started to be observed in the literature.

Lyster (1998) concluded against recasts effectiveness after observing that recasts and non-corrective repetitions fulfilled identical functions and that teachers frequently used positive feedback. Lyster considered that for both teachers and students, the corrective reformulations entailed in recasts may easily be overridden by their functional properties in meaning-oriented classrooms. Nonetheless, other researchers have found diverse data to conclude in favor of recasts as negative feedback.

Later, Ohta (2000) researched the reaction to recasts and proposed a new way to observe whether learners noticed recasts. Among the most important findings reported by Ohta, it is the fact that learners were more likely to react to recast in private speech when it was addressed to other's errors than when addressed to their own ones.

Two years later, Nabei and Swain (2002) presented a case study to investigate the way recasts were used in the theme-based EFL class and to examine the relationship between students' awareness of the recast feedback and L2 learning. The authors concluded that recasts are a complex verbal behavior influenced by the environment of the class, interactional context and learner's cognitive orientation (Nabei & Swain, 2002, p. 43). They claimed that there are paralinguistic elements, as well as linguistic ones related to this NF.

Another context and scope for the study of recasts was the one included by Morris and Tarone (2003) who investigated the impact of classroom dynamics on the effectiveness of recasts in L2 acquisition effect of recast in dyadic conversations in three pairs of foreign language learners. They found that although learners corrected each other's errors by using recasts, erroneous forms were still seen in posttests. The authors discuss that negative feelings towards the interlocutor might interfere in the appropriated perception of recasts because they interpreted recasts as criticism and even mockery instead of helpful feedback. With this study authors highlighted an important issue related to recasts noticing and, in consequence, to acquisition.

Wai (2004) took back the issue of frequency and found recasts to be as frequent as explicit correction, but those recasts did not result in students-generated repair. She also found that phonological repair followed equally recast and explicit correction. Based on her findings, Wai highlighted that recasts are effective for correcting phonological errors, and that recasts open the way to other feedback types (Wai, 2004, p. 187).

Regarding students' reactions to recasts, Balcarcel (2006) performed a study about the types of corrective feedback and the students' responses in EFL higher education classes. The author focused on the types of feedback and on their frequency when used by non-native teachers and their relationship with the students' responses. A group of 12 teachers participated in the study based on 16 recorded hours of interaction. The data were coded according to the categories developed by Lyster and Ranta (1997). Balcarcel (2006) concluded that recasts were the preferred implicit negative feedback and the more frequent explicit forms of feedback were elicitation and repetition. Among those more commonly used feedback types, recast was the second NF in terms of uptake production by learners. The author indicated that teachers can provide a better feedback if they first confirm students' proficiency.

Recasts have been studied in language teaching contexts different to EFL/ESL. Ferreira (2006) collected a corpus from 19 (Spanish as a Foreign Language) SFL students, it lasted about 12 hours of interaction. Those classes took place in different geographic settings (10 from Jamaica, two from Australia and 6 from Scottland). Students' mother language was mostly English, except for two students whose mother language was French and two who were Portuguese native speakers. Ferreira included positive and negative feedback, the latest divided into two groups based on whether the repair was self-produced or provided by the teacher (recast was included in this group). This is an important feature that had not been taken into account by most authors. Results in terms of NF were that strategies from group two (repair provided by the interlocutor) were more effective for grammar and vocabulary errors, while strategies from group one (self-produced repair) seemed to be more effective for pronunciation errors.

Lyster and Mori (2006) examined recasts, prompts, and explicit oral error correction in two different instructional settings: French and Japanese immersion classes, in Canada and in the United States, respectively. They aimed to determine whether learner uptake and repair patterns differed according to instructional setting. After analyzing the data they reported that the most common forms of oral feedback were recast, prompts and explicit correction. Based on the results, they claimed that teachers' behavior in both settings was similar with regards to recasts being the preferred means of responding to learners' oral errors. Lyster and Mori also found that students' responses to recasts were quite different depending upon the instructional setting. They observed that in French immersion classroom prompts resulted in learners' uptake, but recasts did not; whereas in Japanesse settings uptake and repair took place mostly after recasts when compared to prompts. The authors try to explain those mixed findings on the benefits of recasts through their Counterbalance Hypothesis.

Whereas Lyster and Mori (2006) found recasts to be very commonly used in a Japanese immersion class and effective for leading to learners' uptake, Zhao (2008) reported a study on the effectiveness of recast as corrective feedback in China's English classroom interaction where recast was not a frequently used feedback. The author analyzed a corpus containing 30 periods of classroom interaction. Zhao observed that when the teachers provided the students with recasts they intended to use them following the students' grammatical errors, as a result, recasts produced very few students' uptake. That uptake took place just when the students were give waiting times after teacher's recast.

Back to ESL, Tsybina, Girolamento, Weitzman and Greenberg (2006), in a preschool context, found that recasts are somehow related to students' proficiency (as suggested by Balcarcel, 2006; Anmar, 2008; Perdomo, 2008). They suggest increasing recasts rates which should be as simple as possible because complexity reduces language learning opportunities for ESL children. They filmed teachers-learners oral interaction during book reading and play dough activities. They noticed differences in learners' uptake apparently related to students language skills and concluded that more language skilled kids show higher uptake rates when receiving recast as NF.

Later, Nassaji (2009) investigated in the context of dyadic interaction like Morris and Tarone (2003) did. Nassaji studied the effects of recasts and elicitations on learning linguistic forms incidentally presented in dyadic interaction. Besides, Nassaji described the implicit and explicit forms of each feedback type and examined their subsequent effects in two moments (immediately after interaction and after 2 weeks). Participants were 42 ESL adults participating in task-based interaction with two English native speaker teachers. Subjects received various forms of recasts and elicitations when they produced a non-target like output. In terms of immediate post interaction, the results showed a higher degree for recasts compared to elicitations. Nassaji claims that there are explicit and implicit forms of both feedback types studied and that in both cases the more explicit forms led to higher rates of immediate and delayed post interaction correction than the implicit ones, but the effects of explicitness were more pronounced for recasts than for elicitations. Those later findings suggest that although both recasts and elicitations may be beneficial for second language learning, their effectiveness might be closely, but differentially, related to their degree of explicitness. Nassaji, with this study highlights another scarcely researched topic related to recasts: its explicitness, which is not a very common characteristic assigned to recasts in the literature because recasts has been mostly seen as implicit negative feedback.

The study of recast has been associated to other variables; for instance, the to-be-learned structure. Iwashita (2010) conducted a longitudinal case study aiming to examine the long term effects of intensive recast treatments on the development of two grammatical structures. Iwashita concluded that those results support Mackey and Philp's (1998) findings that learner performance on the use of the target features improved as a result of the intensive recasts. The positive effect of intensive recasts was sureinforced by the fact that learners maintained the same level of performance six months after the treatment. The study has implications for teachers' use of error-correction strategies.

One example of studies focused on subjective variables relate to recasts effectiveness was Kayi's (2010) who published a qualitative investigation aiming to investigate the relationship between recasting and intrinsic motivation. It was placed on the foreign language learning context, specifically Turkish as a foreign language. Interactions between teachers, teachers' assistant and students were observed. Some interviews were performed

with students. Results were mixed as long as the researcher found that even when some students reported that recasts developed intrinsic motivation in them, some other said that their motivation was inhibited when they were provided with a recast as they felt unguided, overwhelmed, and did not have control over language use (i.e., recasts would not be helpful for fostering their motivation for various reasons). Kayi (2010) claimed that those results revealed that recasts seemed to foster intrinsic motivation only if students felt that the teacher focuses on communication rather than form and seemed to be willing to build a mutual understanding with the student.

Among studies considering NF, including recasts, related to uptake and repair in children is Choi and Li's (2012) who aimed to investigate the occurrence of corrective feedback and uptake in children ESOL classes. They also explored the relationship between errors, feedback, and uptake. The findings showed that there was a clear preference for recasts and explicit correction, and there was a lack of prompts. Phonological errors led to a high repair rate regardless of feedback types, and grammatical errors mainly received recasts, most of which were not followed by repairs. The authors state that differences in the patterns of feedback and uptake between this study and previous ones might obey to the particular characteristics of the instructional context.

After some years of recast study new approaches to the study of recast are still needed. Asari (2012) saw that necessity after the publication of some research classifying recasts; hence, with the purpose of analyzing their effect by category, the author designed an observational study to answer three main questions: (a) are recasts susceptible to categorization beyond the classification attempted in previous research? (b) How frequently do teachers tend to provide various types of recasts? (c) How does each of those types of recasts affect the quality and rate of uptake? Teacher-learners interactions (a total of 14.7 hours) were transcribed and examined. Error treatment sequences were analyzed and categorized primarily by criteria used in previous studies such as length, degree of emphasis, intonation, segmentation, number of focus, and number of corrections. Asari (2012) also, described the extent to which each type of recasts gave rise to uptake. The author concluded that recasts go beyond being just an implicit form of feedback and that instead should be considered as an implicit-explicit continuum.

Responses to recasts have also been studied in order to know whether they are useful to assess recast effectiveness. Sato (2016) investigated the occurrence of noticing when learners repair, repeat the same error or make another error, fail to respond to the recasts, or acknowledge the recasts. With that study Sato expected to be able to answer whether repair could be counted as a valid measurement of recast effectiveness, and whether acknowledgement can be regarded as a favorable response to recasts in that it accompanies noticing. It was a cases study in which three participants were observed. Participants were regarded as high-intermediate learners; they had already passed the pre-first grade of the STEP Test and were preparing to take the first grade of the STEP Test and they showed no problem communicating in English. Extensive recasts provided during the study fulfill the following characteristics: (a) they were provided immediately after participants' erroneous productions; (b) they were repetitions of all or part of the participants' initial utterances, plus reformulations of students' erroneous productions; and (c) they did not add or change any information from the participants' initial target-like utterances, except for pronouns (whole non modified recasts). Sato concluded that student's repair after the provision of recast can be considered as a sign of noticing.

The studies described above do not constitute the whole package of studies but they represent trends in observational studies and shade light on potential further research for those interested on the topic.

Experimental and quasiexperimental studies

As it has been discussed, several authors have devoted time and energy to investigate recast as negative feedback from different perspectives. In this section a sample of some methodologically more complex studies performed since the beginning of the 21st century to present time will be presented.

Fukuya and Zhang (2002) examined the effects of recasting on learning pragmalinguistic conventions of requests. Participants were 20 volunteer female Chinese learners of English; they were learning eight pragmalinguistic conventions of request in a foreign language setting. The authors expected to experimentally control the presence and absence of the independent variable (i.e., recasting). It was a 10-day study which involved the pretest, posttest, role-plays, a questionnaire, question time, and a class evaluation. In both conditions, pragmatic recast and control, the groups performed role-plays. The former received recasts on their request head acts whereas the latter did not. However, the authors did not deny the possibility of task effect as pointed out by previous researchers. Consequently, they stated that the treatment of the implicit feedback (i.e., recast) had notable effects on Chinese learners of English in learning acceptable requests. The posttest results of the pragmatic recast group appear to indicate their internalization of the cognitive mapping instead of mere imitation of the request conventions. This group used the grammatically correct target forms significantly more often than the control group did. Fukuya and Zhang (2002) consider their results useful in a context of female Chinese College students majoring in English as a Foreign Language with an intermediate English proficiency.

Another pretest-posttest study (posttest being immediate and delayed) was conducted by Zhaohong (2002). In this case, the authors included a small sample (eight adult ESL learners) randomly divided and assigned to one of two conditions: recast or non-recast. The pretest, posttest and delayed posttest

study included eight pedagogical sessions for each group. Written and oral productions primed by cartoons were the ways to get the data. Zhaohong concluded that recasts have a positive effect on L2 learners' awareness. Results also show the possibility to improve oral and written performance for tense consistency. The main contribution of Zhaohong's study is the identification of four conditions that seem to be necessary when using recast in order to facilitate learning: individualized attention, consistent focus, developmental readiness and intensity. More research should be conducted to study the effect of the aforesaid conditions on learning when using recasts.

Leeman (2003) conducted a study based on the concern that even when several authors had written about the benefits of negative evidence, the source of those benefits had scarcely been studied. Leeman claimed that recasts provide both negative and positive evidence that is especially salient. Leeman considered it was an important issue because of the multiple variables that are conflated in recasts. According to Leeman, other salient feature regarding recasts is that they offer not only implicit negative evidence but also positive evidence. Moreover, recasts are believed to make this positive evidence especially salient. The author designed a study where 74 learners of SSL engaged in communicative interaction with the researcher were included in one of four conditions, namely: recasts, negative evidence, enhanced salience of positive evidence, and unenhanced positive evidence (control). For Leeman just the recast and enhanced-salience groups performed better than the control group on post treatment measures by far which may suggests that the utility of recasts is derived at least in part from enhanced salience of positive evidence; it might also be interpreted that negative evidence recasts seem to provide may not be a crucial factor in the interaction.

Among the studies which findings stand against the effectiveness of recast when compared to other feedback types is Lyster's (2004). He conducted a quasi-experimental study to investigate the effects of Form-Focused Instruction (FFI) and corrective feedback on immersion students' ability to accurately assign grammatical gender in French. Four teachers participated as well as their eight classes (a total of 179 fifth-grade students aged between 10 and11years old). For the study, three out of four teachers implemented FFI with two classes (9 hours average) during a 5-week period. Two comparison classes were taught the same subject matter without FFI; those classes were the fourth's teacher responsibility. Each of the three FFI teachers implemented a different feedback treatment: recasts, prompts, or no feedback. The design included a pretest and two posttests (immediate and delayed). Results analyses showed a significant increase in the ability of students exposed to FFI to correctly assign grammatical gender. According to Lyster, results revealed for oral tasks (in a lesser degree than for written ones) that FFI is more effective when combined with prompts than with recasts or no feedback as a means of enabling L2 learners to acquire rule-based representations of grammatical gender and to proceduralize their knowledge of these emerging forms.

Loewen and Philp (2006) examined three main variables regarding recasts: their frequency, their nature and their effectiveness. They found, as well as previous researchers did, that recasts are very frequent in classroom interaction and that they seem to be effective at least in a proportion of 50% of the times they were used. Even when there are other effective feedback types, the authors prefer and recommend recasts because they are time saving, little threatening to students confidence and almost do not interfere the flow of interaction at the time that maintain the focus on meaning during interaction.

Some authors have found a sort of relationship between recasts' effectiveness and students' proficiency. In this vein, Ammar (2008) found that for low-proficiency students prompts were more effective than recasts and no corrective feedback. The aforementioned researcher designed a quasi-experimental pretest and posttest study to examine the impact of recasts in comparison to prompts and no corrective feedback. Subjects were francophone learners and the to-be-acquired content was English third person possessive determiners. Other authors have also noticed that recasts seem to be more effective for high proficiency students, for instance Perdomo (2008) who found more proficient students to benefit more from recasts. She assessed the effectiveness of oral recasts in an EFL context where participants were college students. The design included two intact classes and a female teacher who taught EFL to both. The to-be-learned contents were the adequate use of the auxiliary verb 'to have' and the use of past participles in the present perfect tense. Each group was randomly assigned to one of the conditions: (1) Recast or (2) explicit negative feedback. In both conditions students received positive feedback. Conversation was elicited by using pictures. An oral test similar to the class activities was performed by the students. The author found recasts to be more effective than explicit negative evidence in terms of learning.

Sheen (2008) investigated affective factors related to recasts within a pretest – posttest (immediate and delayed) design. Specifically, the author aimed to find out (a) whether classroom language anxiety affects learners' ability to improve accuracy in their use of English articles when provided with corrective feedback in the form of recasts and (b) whether language anxiety influences the extent to which learners modify output following recasts. In other words, Sheen explored subjective factors related to recasts effectiveness. A questionnaire measuring language anxiety was performed and based upon its results four groups were established: two high-anxiety learners groups and two low-anxiety learners groups. In Sheen's (2008) groups (high and low anxiety) there were two conditions depending on the provided feedback (recasts and no recasts).

For the two recast groups, two treatment sessions directed at article errors took place and were audio-taped. Transcriptions were then coded for the frequency of recasts and modified output. Sheen found that the low-anxiety recast group outperformed the high-anxiety recast group and the low-anxiety control group, but there was no significant difference in the performance of both high-anxiety recast and control groups (no recasts). The author stated that recasts were most effective for low-anxiety learners who produced high levels of modified output. Based on Sheen's findings, it possible to say that language anxiety is a factor influencing not only whether recasts lead to modified output but also whether they promote learning. Due to the small sample, it is necessary to continue researching in the same context and in different language teaching and learning setting before providing more conclusive claims.

Looking into different teaching contexts and learners interactions, Lyster and Izquierdo (2009) studied the differential effects of prompts and recasts, in dyadic interaction, on the acquisition of grammatical gender by 25 undergraduate adult second language learners enrolled in an intermediate-level French course at an English-speaking university. Participants were randomly assigned to either the recast or prompt group. Students received three-hour form-focused instructional treatment. On two occasions outside classes, individual students participated in three different oral tasks during dyadic interaction with a native or near-native speaker of French who, following learner errors in grammatical gender, provided feedback in the form of either prompts or recasts. The authors included two oral production tasks and a computerized reaction-time binary-choice test. Results indicated no differences between the two feedback types. Learners receiving recasts benefited from the repeated exposure to positive exemplars as well as from opportunities to infer negative evidence, whereas learners receiving prompts benefited from the repeated exposure to negative evidence as well as from opportunities to produce modified output.

Rouhi and Hassanpour (2010) examined the moderating effect of second language learners' aptitude level on L2 development induced by on-time and immediate recasts on 60 Azari learners of ESL who were assigned to on-time and immediate recasts groups. Those groups were homogeneous in terms of L2 proficiency. Two subtests of MLAT were given to the participating groups to get aptitude indices for every single individual. The erroneous utterances of learners received recast instantly or delayed depending on the experimental condition. The author observed that learners were capable to notice on-time recasts much more than the immediate ones. Learners with high grammar sensitivity and rote memory noticed both types of recasts better than the learners with low grammar sensitivity and rote memory. Results showed that the effect of recasts on L2 accuracy improvement was moderated significantly by the aptitude level of L2 learners and that the participants in the on-time group noticed L2 forms significantly in a larger amount than those in the immediate recasts group. There was a not statistically significant difference for interaction between the aptitude level and the recast type.

One of the few studies comparing different types of recasts is Zhuo's (2010). Zhuo conducted a pretest – posttest study to examine the relative effects of explicit and implicit recasts on the acquisition of English noun plural by Chinese EFL primary school learners. Participants were randomly assigned to either the explicit recast group, implicit recast group or control one. All the students filled an information gap task with the researcher individually. Each group received the correspondent feedback for the target linguistic errors during the task performance. The pretest, immediate posttest and delayed posttest were a grammatical judgment test and a metalinguistic knowledge test. All three groups improved significantly over time; yet, the explicit recast group did significantly better than both the implicit recast group and the control group. The author discussed the findings taking into account the noticing hypothesis, autonomous induction theory and counterbalance hypothesis and concluded that the superiority of explicit recast implied a beneficial role for negative evidence in SLA and that explicit recast was a better choice than implicit recast in the L2 classroom. However, more research in different settings is needed to decide whether explicit recast is the one to include in studies to know recasts effectiveness when compared to other negative feedback types.

In the same vein, Rassaei, Moinzadeh and Youhannaee (2012a) compared the effectiveness of recasts that triggered learners' modification to their incorrect forms with recasts that triggered no modified output by using a tailor-made design. The sample included 60 Iranian EFL learners who received recasts during task-based interactions. They found that recasts followed by learners' modified output were more effective on promoting L2development when compared to recasts with no modified output prompted. The authors indicated that recasts can promote the accuracy of L2 knowledge particularly when they are followed by learners' modified output. In other words, recasts which are followed by learners' modified output are more effective than recasts with no modified output, because the later are less salient to learners.

Révész (2012) studied whether the observed effectiveness of recasts is influenced by the type of outcome measure used and whether different aspects of working memory are differentially associated with learners' performance on the various outcome measures. Participants were 90 EFL learners who were randomly assigned to one out of three conditions: recast, non-recast, or control group. The study had a pretest-posttest-delayed posttest design, and the grammatical structure under study was the English past progressive construction. The highlighted findings indicated that recasts generated the greatest gains on an oral

production test, lesser gains on a written production test, and the least gains on a written grammaticality judgment test.

Another pretest-posttest (immediate and delayed) design was used by Yilmaz (2012) who also challenged recasts effectiveness in diverse language teaching settings. Besides, Yilmaz included the communication mode variable within the study. He investigated the effects of explicit correction versus recasts; face-to-face communication and synchronous computer-mediated communication; and salient versus non-salient target structure on the acquisition of two Turkish morphemes. The study was conducted with a pretest, immediate and delayed posttest design. Data were collected while 48 native speakers of English without Turkish background developed two communicative tasks. Their errors were treated according to their feedback group (explicit – recast). Learners' resulting performance was measured through oral production, comprehension, and recognition tests. Yilmaz reported that explicit correction was better than recasts in the oral production and comprehension tasks (for both immediate and delayed posttests). Even when neither communication mode nor target structure salience moderated the difference between the negative feedback types, both factors made independent contributions to feedback effectiveness.

Farrokhi and Hassan (2012) investigate about what type of corrective feedback would be useful for Iranian EFL learners' oral accuracy. They designed a quasi-experimental study in which three intact classes were randomly selected. Conditions were: control (n=17), recast (n=19) and delayed explicit and metalinguistic group (n=21). The task for data collection was story retelling; six sessions of the task were recorded. For the recast group, students were provided with recasts on their simple past tense errors; for the delayed explicit and metalinguistic group, the researcher corrected the learners' errors after they finished the retelling; and for the control group, there were no feedback on learners' errors. To measure learner's improvement they considered their oral accuracy during the six sessions. Experimental groups did better than control in story retelling. Both corrective feedback types were equally effective in promoting learners oral accuracy. Based on their findings Farrokhi and Hassan (2012, p. 77) concluded that intensive recasts that are repeatedly focused on a particular structure are not different from explicit types of feedback in terms of their effectiveness.

Among more recent studies exploring recasts effectiveness is Saitos' (2015). Saito conducted a quasi-experimental design research with a pre-test and post-test in a simulated ESL classroom setting to investigate the way recasts can promote the L2 pronunciation development of word-initial /ɹ/ by Japanese ESL learners. The study involved fifty-four volunteer Japanese learners of English who received four hours of form-focused activity from two experienced ESL teachers who taught some classes to each group. Conditions were pronunciation focused recasts (n = 29) and no recasts (n = 25). The experimental group (pronunciation focused recast) significantly lowered the extent of acquisition. Saito also found recast effectiveness related to the amount of recasts and repairs and initial pronunciation levels.

Karimi and Esfandiari (2016) compared the effect of recast and explicit corrective feedback on female Iranian EFL learners' stress patterns learning. A pre-test and post-test study was performed with sixty participants were randomly assigned to three groups: recast (n=20), explicit corrective feedback (n=20) and control (n=20). Both recast and explicit corrective feedback showed positive effect on the learners' stress patterns learning, but the effect of recast seemed to be stronger than that of the explicit corrective feedback. However, some methodological limitations might have an influence on the results for which further research correcting those issues would be helpful.

Research regarding recast variety has continued even when it has not been very abundant. Among authors having noticed the importance to study different types of recast compared among them are Elhami and Roshan (2016) who studied whether full and partial recasts do not make a statistically significant difference in two grammatical structures (third person "s" or simple past "ed"). Participants were 32 EFL elementary level Iranian students. Authors concluded that, different to Mackey's (2006) claims, full and partial recast did not function differently for varied grammatical structures.

Recast study has changed not just in terms of focus but also methodologically. For instance, Hawkes and Nassaji (2016) tried a new testing methodology (video-based stimulated correction posttest) in a laboratory within-group research design to examine whether extensive and spontaneous recasts provided during small group work were beneficial to adult L2 learners. They worked with a short sample of 26 ESL learners divided into seven groups (3-5 students each) and included students' reaction time on the error detection portion of the stimulated correction task. The authors reported that students were able to detect more errors when errors were followed by the provision of a recast than when no recast was provided. In terms of the reaction time, authors report that results also point towards a benefit from recasts. However, due to sample size more studies should be conducted before taking results into account for decision making in the classroom.

On the same track of studying recasts effectiveness in different sets and related to different variables, Khanmohamadi and Rezvani (2017) aimed at examining the combined effects of task complexity and recasts on the acquisition of conditional sentences. Their pre-test and post-test study. They were 90 students from Sadr institute of higher education aged between 18 and 30. Participants were homogenized in terms of language proficiency through the Oxford Placement Test (OPT). Participants were assigned to three groups: Complex

Task Group (CTG), Simple Task Group (STG), and control. Their results showed that both experimental groups displayed evidence of significant improvement from pre-test to post-test; however, the treatment for the CTG was found to be more effective than that used for the STG. The authors concluded that providing Iranian EFL learners with recast in both STG and CTG exerts a significant improvement on their production of conditional constructions over their peers that were not introduced to recasts. Like in Karimi and Esfandiari's (2016), they included just female students for which more studies including also males is needed to asses a possible gender effect.

As it can be observed, recast as negative feedback has been studied in terms of its effectiveness, frequency, its relationship to subjective factors, recast's explicitness and other variables. However, more research is needed in order to determine more precisely recasts' effectiveness in different sets and conditions.

Discussion

Recasts has been reported in the literature as one of the most common NF in native speakers and nonnative speaker interaction in different settings; however there is not sound evidence to properly claim that it is also the most effective for all teaching situations and language learners. As recast has been labeled as a very frequent NF in the classroom, teachers need to be careful and to ensure they are using a NF strategy that really helps students; otherwise they need reduce its use in the classroom and start incorporating other NF types. Teachers need to make a critical appraisal of the range of NF choices and their suitability for each particular language learning context and each particular group of students (taking into consideration characteristics such as age, gender, proficiency, among other). For language teaching eclectic methodologies are a wise way; in the same way, negative feedback variety in the classroom according to the situation might also be.

After briefly reviewing recasts time line it is possible to observe that there has been an evolution in terms of widening the range of issues regarding recasts that have been studied. However, results of research are still controversial and in some cases might be compromised by interfering variables which might have not been controlled. Thus, Perdomo (forthcoming) posits, before making a point, teachers and researchers should carefully review investigation regarding recast effectiveness to identify possible bias (e.g., the to-be-learned structure, nature of feedback compared, learners' age, type of recast used in the study).

Recasts saliency has been questioned in the literature; however, it has scarcely been studied in sound well designed studies. Also, more research is needed on learners' perception of recasts (i.e., how do they perceive it, how that perception affects recasts effectiveness). More studies would be helpful to assess the long term effectiveness of recasts in certain language learning sets. Effectiveness of recasts has to be studied for a wide range of grammatical situations because you may not recommend recasts just based on a study in which it seemed to be successful for a specific grammatical issue.

Several criticisms can be made after some studies, especially those comparing recast to other feedback types, namely the authors did not consider the type of recast or (as other researchers call them) recasts characteristics which may have an effect on recasts effectiveness because affects recasts nature. In this sense, it is not totally recommended to bet on recasts effectiveness in the EFL/ESL environment, but one may not totally deny it either because more research is still to be done. A research path based on the comparison of different types of recasts (see Perdomo forthcoming) as initiated by Elhami and Roshan's (2016), for example; will be useful to find out which of them seems to be more common and more effective and then, to keep on comparing recasts properly. A recommendation for researchers is to specify the type of recast they are comparing to other NFs in order to draw more specific and clear conclusions.

Final comments and Conclusions

It has been more than two decades after researchers started publishing studies regarding recast and second/foreign language learning contexts; however much is still to be done to provide teachers solid evidence for proper decision making on behalf of the FL/SL learners. The information that has been presented in the current paper might be useful for teachers and researcher to keep researching on recast as NF because besides showing a part of what has been investigated, it shows the blanks still remaining on the topic.

A careful objective review of studies with results against recast effectiveness would be also useful for decision making in the language classroom. One important issue language teacher practitioners should consider is the conditions in which those studies have shown recasts to be either effective or non-effective. One cannot promote its use in every context but in those similar to the ones in which it has shown to be effective under sound research. A negative feedback that seemed to work in a lab setting for beginners might not be useful for real classroom settings with intermediate students; in that case, teachers should involve in their roles of researchers to approach answers suitable for their contexts.

In terms of further research, it is still a fertile soil even when there is a trend of researchers claiming that recasts are not effective and hence not recommended for the language learning situation.

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THE INVESTIGATION OF AIR, HEAT AND SOUND PERMEABILITY OF PERLITE COATED NONWOVEN FABRICS WITH DIFFERENT WEIGHTS

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Abstract: In this study, polyester (PET) nonwoven fabrics with different weights were coated with perlite stone powder with particle sizes between 210-590 µm. Before coating procedure, water repellency treatment was applied to the samples and then the same amount of polyurethane base coating with perlite stone powder was applied on the nonwoven samples. After coating, the samples were cured at 100°C for 10 minutes. Finally, air, heat, and sound permeability of samples were investigated with regards to the weight of samples. According to the results, the increase in weight of samples caused to improve air permeability and acoustic insulation of samples. Furthermore, the decrease in weight of samples caused to decrease in the thermal conductivity coefficient of samples.

Keywords: Nonwoven, Air Permeability, Thermal Insulation, Acoustic Insulation

Introduction

In the world, energy consumption causes to increase pollution, environmental degradation, and global greenhouse emission. Building, transportation, and agricultural sectors are the most effective sectors to contribute to energy consumption. Furthermore, almost 40% of energy consumption results from the building sector (Pargana et al., 2014).

The growing environmental awareness throughout the world induces to use insulation materials resources in the all sectors (Nguyen et al., 2014). Moreover, high energy consumption, and climate changes obligate to use more sustainable and energy saver materials. Especially, thermal insulation materials play an important role in energy saving. In the buildings, to achieve better thermal insulation with commonly used insulation materials, thicker walls are suggested. However, the use of thicker walls can cause to increase cost and effect architectural restrictions. Consequently, in order to meet the demand of energy efficiency in buildings, it is necessary to develop thermal insulation materials with low thermal conductivity (Patnaik et al., 2015).

In thermal insulation applications, the widely used insulation material in the building industry is glass fiber derived from silica and synthetic fibers based on petroleum resources. Furthermore, demand for the use of sustainable, natural, and biodegradable materials has increased day after day (Patnaik et al., 2015). In the literature, Korjenic et al. investigated the thermal insulation properties of composites reinforced with jute, flax, and hemp. According to the results, the thermal conductivity coefficients of samples are 0.0458-0.0393 W/m K (Korjenic et al., 2011). In the other study, the thermal conductivity coefficients of cotton stalk fibers were investigated. The results show that the thermal conductivity coefficient is correlated with density. The thermal conductivity coefficients of samples are 0.0585 to 0.0815 W/m K, which is close to the expanded perlite (Zhou et al., 2010). Da Rosa et al. produced six insulating boards with the use of rice husk, sunflower stalks, and gypsum as binder. The thermal conductivity coefficients of samples are low values (Da Rosa et al., 2015). In order to gain thermal insulation to buildings, the textile materials are used as construction materials (Briga-Sá et al., 2013; Arumugam et al., 2015; Chen et al., 2015).

Since perlite stone has porous structure and cost-effective, it is used as acoustic and thermal insulation material. Furthermore, perlite stone is natural, biodegradable, ecological, and sustainable material. Because of having such properties, perlite stone is used in thermal insulation, agriculture, and filtration sectors (Kabra et al., 2013). The chemical composition of perlite stone is given in Table 1.

Table 1. Chemical Composition of Perlite (Raper and Raper, 2014).

Compositions	Quantity (%)
SiO_2	70-75%
Al_2O_3	12-15%
Na_2O	3-4%
K_2O	3-5%
Fe_2O_3	0.5-2%
MgO	0.2-0.7%
CaO	0.5-1.5%

In this study, in order to improve the thermal and acoustic insulation properties of PET nonwovens with different weights, the samples were coated with perlite stone powder. The results show that the weight of samples effects the thermal conductivity, air permeability, and sound absorption properties.

Materials and Methods

Materials

In this study, PET nonwovens with different weight such as 120, 140, 180, and 500 g/m^2 were used for the experiments. In order to improve the thermal and acoustic insulation properties of fabrics, perlite stone powder grinded by using ball mill and sifted to get a particle size between 210-590 μm was used. Perlite stone powder was coated with polyurethane based binder to PET nonwoven fabrics. In order to prepare coating paste, RUCO-COAT PU 1110 (Rudolf Duraner), RUCO-COAT FX 8011 (Rudolf Duraner), and RUCO-COAT TH 821 (Rudolf Duraner) were mixed. The coating chemicals were purchased from Rudolf Duraner Incorporated Company, headquartered in Bursa, Turkey. The properties of coating materials are given in Table 2.

Table 2. The Properties of Coating Materials.

Material Name	Properties of materials
RUCO-COAT PU 1110	Water based aliphatic polyether polyurethane dispersion in anionic form
RUCO-COAT FX 8011	Blocked isocyanate cross-linking agent in anionic structure
RUCO-COAT TH 821	Synthetic thickener acrylate in anionic structure

Water Repellency Finishing Treatment

PET nonwovens were applied with water-repellent finishing by using RUCODRY DFY fluorocarbon based and purchased from Rudolf Duraner Inc. in accordance with padding method in order to impede absorbing of nonwoven fabric of polyurethane based coating material. Then, the samples were dried by using stenter drier (ATAC Lab. Machines GK40E) at 100°C for 5 min.

Coating Procedure

PET nonwoven fabrics were coated with polyurethane and perlite stone powder by the use of ATAC Lab. Machines RKL40 coating machine. After coating process, samples were dried at 80 ºC for 10 minutes by the use of ATAC Lab. Machines GK40E dryer machine.

Measurement of Thermal Conductivity

Thermal conductivity coefficients of the samples were measured by using P.A.HILTON LTD.H940 instrument according to the TS 4512 Standard (TS 4512 Standard: Determination of heat transfer coefficient of textile materials, 1985). The samples were prepared in 25 mm diameter. Thermal conductivity coefficients of samples were calculated with the following equation (Kılıc and Yigit, 2008),

$$Q = -k.A.\frac{dT}{dx}$$

where Q is the heat flow (W), A is surface area (m²), x is the thickness of sample (m), T is the temperature difference (K), and k is the thermal conductivity coefficient (W/m K) of sample.

Measurement of Acoustic Insulation

Sound absorption coefficients of materials were measured in accordance with ISO 10534-2 standard (ISO 10534-2 Standard. Acoustics – determination of sound absorption coefficient and impedance in impedance tubes – Part 2: Transfer-function method, 1998) by using a measuring instrument of Brüel & Kjaer Impedance Tube, which is based on two microphone transfer function method.

Measurement of Air Permeability

Air permeability test was carried out under 200 Pa pressure and 20 cm^2 testing area according to DIN53887 test standard (Standard: DIN 53887 Testing of textiles; determination of air permeability of textile fabrics, 1966).

Results and Discussion

Measurement of Thermal Conductivity Coefficients

Thermal conductivity coefficients of samples were calculated with the Fourier equation. Figures 1 and 2 show the thermal conductivity coefficient of samples coated with perlite stone powder.

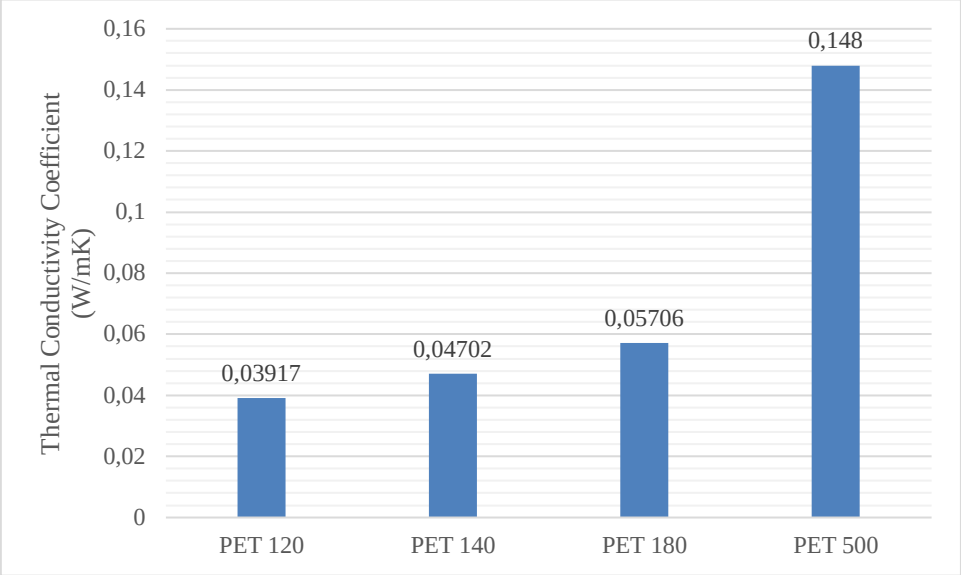

Figure 1. Thermal conductivity coefficients of PET nonwovens.

Thermal insulation and thermal conductivity coefficients are inversely proportional. The meaning is that the material with low thermal conductivity coefficient is ideal for thermal insulation applications. It is seen from Figure 1, PET120 nonwoven sample has better thermal insulation. Because of low thickness of PET120 nonwoven sample, it has better thermal insulation property. Besides, the thickness and the thermal insulation coefficients of the materials are directly proportional. In other words, a decrease in material thickness causes to decrease the thermal insulation coefficient.

Measurement of Sound Absorption Coefficients

Figure 2 shows the sound measurement results of the nonwovens.

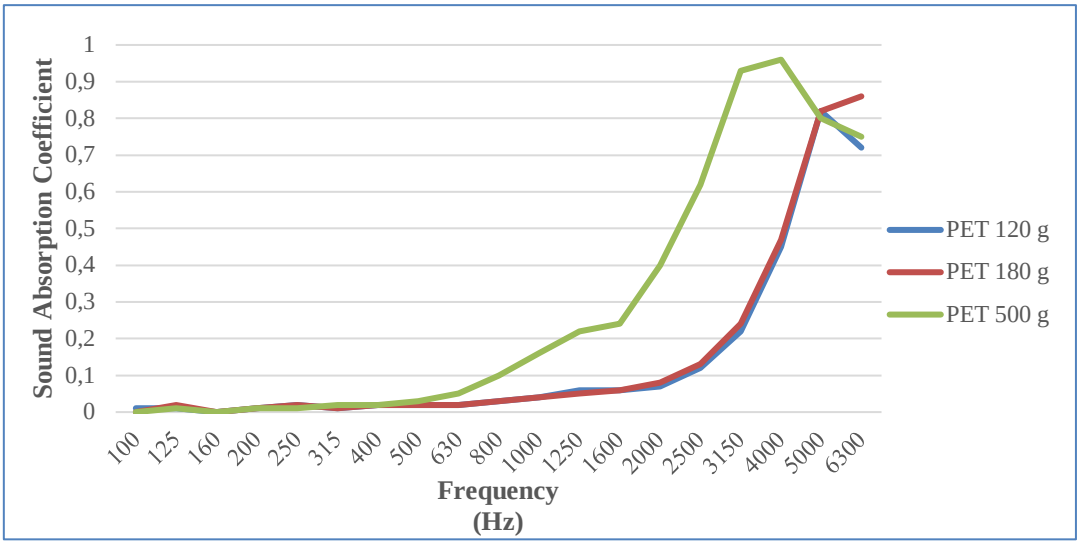

Figure 2. The Sound Absorption Coefficients of PET nonwovens.

According to the results, the sound absorption coefficient increases with the weight of samples. It is considered that increase of material thickness causes to increase in the amount of micro pore within the sample. It is observed that PET500 nonwoven fabric has the best sound absorption property. Furthermore, PET500 nonwoven is the thickest material. The increase in thickness of surface causes to increase the travelled distance of sound waves. As a result, the frictions between sound waves and surface increase and the amount of sound energy converted lost heat energy rises.

Measurement of Air Permeability

The air permeability results of the nonwovens are given in Figure 3.

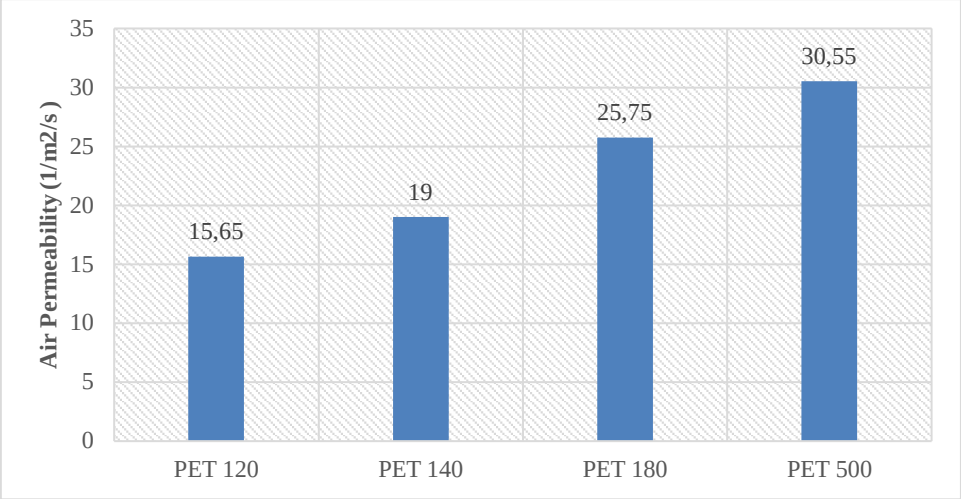

Figure 3. Air Permeability of PET nonwovens.

According to the air permeability results, the increase in weight of samples causes to improve the air permeability of samples. Moreover, it is deemed that the amount of air in PET 500 nonwoven is more than the other samples.

Conclusion

In this study, the use of PET nonwovens in building textiles was investigated to improve thermal and acoustic insulation. For this purpose, PET nonwovens with different weights were coated with perlite stone powder. After the coating process, the air permeability, thermal and acoustic insulation properties of samples were compared with regards to the weight of samples. According to the results, the increase in weight caused to improve the acoustic insulation and air permeability of samples. Furthermore, the decrease in weight of sample caused to increase in thermal insulation.

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TYPES OF *DA`WAH* COMMUNICATION USED BY *DA`WAH* WORKERS IN CONVEYING THE MESSAGE OF ISLAM TO THE ABORIGINALS

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Abstract: *Da`wah* communication is the process of conveying information about Islam by a muslim communicator to the recipient in order to achieve a certain objective that is in line with what is outlined in al-Quran and al-Sunnah. In the effort to develop an effective *da`wah* communication, mastering the types of dakwah communication is imperative in ensuring the continuation of its messages. This is an addition to other factors that help contribute to the success of *da`wah* such as the aspects of preparation, expertise, skills and the mastery of the *da`wah* workers when they engage with the target group. Therefore, this study aims to identify the types of *da`wah* communication used by the *da`wah* workers in order to convey the *da`wah* messages to the target group which is the aboriginal (Orang Asli) community. This qualitative study utilizes the case study design. Eight *da`wah* workers from Penggerak Masyarakat Orang Asli (PMOA) and Panel Dakwah Muallaf (PDM) in Selangor and a research informant are chosen for interviews. The data are organised and coded based on the themes and categories obtained from the complete transcription. Then, the data are analyzed descriptively. The findings show that there are three initial processes used by *da`wah* workers in developing the types of *da`wah* communication. It involves the initiatiation stage, planning as well as the preparation to begin a conversation on a certain topic when communicating with the Orang Asli. In order to ensure effective communication, the *da`wah* worker is not only applying verbal communication, but also non-verbal communication in order to open the channel of communication for da`wah. All the three stages influence the efficacy of the *da`wah* messages presented and give a positive impact towards the Orang Asli community. The implication of this study is on the stakeholders i.e. the organizations that have close relations to the Orang Asli like Jabatan Kemajuan Islam Malaysia (JAKIM), states' religious councils like Majlis Agama Islam Selangor (MAIS) and non-government organizations (NGOs) within the scope of improving the the quality of *da`wah* and indirectly improving the quality of the use of language among *da`wah* workers in communicating the message of *da`wah* to the Orang Asli community.
Key words: *Da`wah*, coomunication, Islam, Aboriginals, Orang Asli

Introduction

In Islam, the term used to introduce and spread the divine message to others is called *da`wah*. The person who undertakes the work of *da`wah* is called as *da`i*. However in this article the term used for *da`i* or caller of Islamic message is *da`wah* workers. According to Sohirin (2008), the work of *da`wah* is focused on calling others into the religion, worship, and offering love to God. Beside that, *da`wah* work is an effort that requires the strife of energy, intellect and material in order to achieve a particular objective. It calls for determination on the part of *da`wah* workers to engage the target audience using a particular method or approach. However *da`wah* work is not an easy job as approved by Syed Abdurrahman (2008) because it deals with the matter of altering the belief and understanding of a human being. Thus this agrees with the meaning of *da`wah* as proposed by al-Bahi al-Khawli (1979) that the *da`wah* movement attempts to lift a person out from an environment and put him into another. This is in line with the view presented by Mohd. Amin Abdul Rahim (2010) who states that *da`wah* work requires for *da`wah* workers who are committed to carry out the effort full time and it is not an easy task. The explanation for this is that the *da`wah* workers must engage with the target group from all kinds of backgrounds i.e. different beliefs, customs and levels of education and thinking. All these according to `Abd Allah Nasih `Ulwan (1985), need for a *da`wah* worker who is wholly prepared in terms of knowledge, physical and spiritual. Besides that, the main challenge to an effective *da`wah* work comes from the *da`wah* workers themselves whereby the way they present themselves and the approach that they apply to interact with the target group play a crucial role. Therefore, according to Mohamad Natsir (1978), the best approach is the approach inspired from the Quranic verse (surah al-Nahl 125) that focuses on the approach of *al-hikmah, al-maw`izah al-hasanah* and *al-mujadalah bi al-husna.*

Mohd. Amin Abdul Rahim (2010) states that there are six factors that contribute to the acceptance of the target group towards the *da`wah* messages. These factors are the management and administration of *da`wah*, attitude of the recipient of *da`wah*, the conscience of the *da`wah* worker that is not easily influenced, imbalanced emotional state and wrong delivery technique. There are two causes why the target group resists the *da`wah* brought to them and these include the target group's background and their attitude towards the *da`wah*. In the context of the recipient's attitude, a few reasons contribute to the recipient's refusal to accept the *da`wah* and these reasons being the incongruity between the message and the values, the attitude and belief of the recipients as well as apathy and scepticism towards the message brought by the *da`wah* workers. This is because they assume that the messages brought to them do not have anything to do with their needs and interests. Among the consequences of this is that they either take a neutral stand or totally reject the messages if there arises any doubt. Meanwhile, the image presented by the *da`wah* workers will have a bearing on whether the *da`wah* is accepted or rejected. This involves the credibility and expertise of the *da`wah* workers and their competency in delivering the message, their commitments towards the message and the recipients, the sincerity and honesty of the *da`wah* workers in carrying out their duties and also their dynamism and agility when they are on the ground engaging their target audience.

In the context of *da`wah* to Orang Asli, according to Syed Abdurahman (2008) there are three main obstacles that become the cause as to why *da`wah* reaches orang Asli in a sluggish manner. Firstly, the *da`wah* workers themselves are the obstacle, then the obstacle from the target group and finally the obstacle from external entities. From the side of the *da`wah* workers, there is a shortage of capable, talented, skilful and competent *da`wah* workers to carry out the *da`wah* work. This is confirmed by Ramlee (2015) who states that a major part of the problem faced by the *da`wah* workers is related to their skills in conveying the message of *da`wah*. Meanwhile Hood Salleh (1991) adds other problems faced by the *da`wah* workers are they do not equip themselves with the basic information about their career, they lack in motivation in getting acquainted wdith their audience which leads to their lack in eagerness to carry out the *da`wah* work, in addition to that the effort of the missionary workers that does not receive support from the local community especially the Malay community who majority of them do things which are deemed anti-social by the target group (Orang Asli) and finally the missionary workers are ill prepared in terms of character management where they are seen as being arrogant.

Research Methodology

This qualitative study utilizes the case study design. Data collection for this study involves eight research participants and also an informant while semi-structured interview method is used as the research instrument. The research subjects are the *da`wah* workers who are directly involved in the *da`wah* to the Orang Asli community in Selangor, Malaysia from two entities that call themselves Penggerak Masyarakat Orang Asli (PMOA) and Panel Dakwah Muallaf (PDM). In this particular writing, the term used that indicates *da`wah workers* as PK or *Peserta Kajian* (in English we called them as subject matter). Purposive sampling is used in the process of research sample selection. The pilot study is conducted in order to increase the level of reliability of the interview questions constructed. Based on Cohen Kappa's estimation it indicates that the level of reliability achieved should be 1.0, that is, it is in the highest wrung of the indicator. The data analysis process is done by organizing the findings according to themes and sections which have been constructed for every question that answers the research objectives.

Types of Communication in *Da`wah*

The process of *da`wah* takes place when the *da`wah* workers communicate with the *da`wah* target group in order to convey the message of *da`wah* (Toto Tasmara, 1997). Thus, *da`wah* workers must use the type of communication that is suitable for a communicator in order to influence and steer the accetance of the message by the the recipient based on what is stipulated in the Islamic rules and regulations. When the *da`wah* workers choose the suitable type of communication that suits the recipients' state, it is a way to ease the process of providing understanding about the message that is to be conveyed (Asep Syamsul 2013). Type of communication used is not restricted to verbal communication only, but also non-verbal. Added to this is usage of the written form and the situational language that can ensure that the *da`wah* message conveyed can be well accepted and understood by the recipients (Zulkefli & S. Salahudin 2016).

As an example, in the context of verbal communication the communication process happens when the *da`wah* workers use a specific language medium to convey the message of *da`wah* to the recipient through verbal medium like public speaking, sermon, dialogue and discussion. This agrees with what is stated in al-Quran (Verse Ibrahim: 4) where Allah says "We sent not a Messenger except (to teach) in the language of his (own) people, in order to make (things) clear to them. Now Allah leaves straying those whom He pleases and guides whom He pleases: and He is Exalted in Power, Full of Wisdom." According to al-Qaradawi (2011) this Quranic verse does not only mention the type and medium of language of the communicator like English and German. It also gives the focus on the function and role of language in verbal communication. As an example, when a person communicates with the public he/ she tends to use the colloquial language in order to suit the public's level of thinking. In relation to that, in order to create the verbal communication guideline, Zulkefli and S.Salahudin (2016) propose that the following ethics that should be taken as a procedure in verbal communications like: the topic of conversation between the communicator and the recipient should be about something that is good and beneficial, the communicator avoids saying things that are not beneficial, he/ she is truthful in his/ her words, he/ she does not expose other people's weaknesses, he/ she does not say bad things and look down on others and finally he/ she observes the ethics when differing in views with others.

Meanwhile situational communication refers to the *da`wah* workers' effort to communicate with the recipients using an approach that is oriented towards expanding and developing the community within a specific sector like economy and education (Zulkefli & S.Salahudin 2016). Through this type of communication, the *da`wah* message is conveyed in a "silent" manner by way of doing good deeds in the form of community activities and also development until they are capable of influencing the target group and it is more effective compared to the message that is conveyed verbally for example through talks and speeches (Kustadi 2013). *Da`wah* workers act as the agent of change for the community in order to help them increase their quality of life in certain fields like in economy. According to Mohd. Yusof Hussain (2009) among the roles and functions of the *da`wah* workers are helping the community to identify their needs deemed suitable, to get the support from the leader and members of community in carrying out the community development project, to help the community carry out the project, to provide the necessary expertise to the members of the community, to provide them with the motivation, to become their source of reference to ensure that the project is properly done and to help in making the evaluation of the project planned or the project that is being carried out.

Findings and Discussion

The findings of the study show that when communicating with the Orang Asli Community, the *da`wah* workers from PMOA and PDM mainly use verbal communication that is made up of three levels in their effort to build the rapport with the Orang Asli for *da`wah* purposes. The levels mentioned are referring to the initial process to build the rapport, strategy, topics of conversation that will lead up to the *da`wah* communication with the Orang Asli being formed.

1. The Initial Process in Developing the Communication Form for *Da`wah*

The research finding shows that PK 1 until PK 8 are in agreement that Bahasa Melayu (i.e an official languange used by Malaysian) is the medium of communication used when communicating with Orang Asli. For them, it is the initial step in order to begin the process of communication with Orang Asli. Based on the interview it is found out that the *da`wah* workers use verbal communication in order to establish the line of communication between the them and the Orang Asli. This is the form of verbal communication used by God's Messenger when he was conveying the message of truth to his people as narrated in Al-Quran (Verse Ibrahim: 4).

Jumiya's (2014) study however discovers that the mastery of Bahasa Melayu among Orang Asli is very low and they have difficulties to understand it. Meanwhile, a research finding proves that the Orang Asli community in Selangor are able to communicate and understand Bahasa Melayu in in their daily life. Moreover, a study by Rohani & Noor Hasnur (2014) finds out that Bahasa Melayu and Melayu-Proto (language used by one of Orang Asli group) have similarity in dialect. This is because it is made up of cognate features and phonological system in the language used. This means that the terms used give the same meaning and are easily understood. More clearly, the statement by Muhammad Busu (2016) who says that the usage of terms in the language of, especially, the Orang Asli Temuan community is very similar to the usage in Bahasa Melayu used for the purpose of communication.

Besides using Bahasa Melayu as a medium of interaction, PK 6 also opines that as a person who does *da`wah* work, the "friendly face" skill must be possessed by the *da`wah* worker in order to ease the process of communicating with the Orang Asli. He explains that the "friendly face" skill can be explaines as for instance always giving away a smile, greeting another Muslim with "Assalamualaikum" or greeting with "selamat sejahtera" and "good morning" for the non-Muslims. This effort is an early sign of building a cordial relationship with the Orang Asli community.

The research finding shows that effort shown by the *da`wah* worker is in line with Mc Auley's (1988) statement that facial expression, eyes and body movement can have a big influence in communication. This suggests that the missionary workers must also apply the non-verbal communication process in their effort to build the rapport with the Orang Asli. This is in line with Marlyna Maros & Mohd. Baharim's (2011) research finding that greeting is an early move to develop a communication between two parties. It is also found out from the study that there are two aspects of greeting i.e. verbal greeting and non-verbal greeting. Verbal greeting involves communication such as saying hello and non-verbal greeting involves communication with body language like smiling.

Besides the usage of Bahasa Melayu and the "friendly face" skill, the study also shows that there is a similarity in the views of PK 3, PK 5, and PK 8 that is the *da`wah* workers must learn about the background and lifestyle of Orang Asli. This approach is important in order to create a harmonious and friendly surrounding between them and the Orang Asli community. The finding also indicates that there should be effort on the part of the *da`wah* workers to learn about the life of the Orang Asli like the work they do and their daily activities. This shows that they are genuinely interested to get acquianted with the Orang Asli. In fact, the interview with the informant shows that the *da`wah* workers should not create a gap between themselves and the Orang Asli because it is feared it can lead to a negative impact on the *da`wah* process. The following is what the informant says about this:

> "First, first impression means we must have adequate preparation. The preparation when entering the Orang Asli village has to be in terms of mental, emotion and knowledge. Knowledge is the most important... When we communicate with the Orang Asli, it has to be that we already have information and knowledge about them… when we form a gap from the very beginning, we have already failed".
>
> (Informant 1: 2-26)

This includes the aspects of lifestyle, food, occupation, customs and culture of the community. The knowledge about the Orang Asli's background is important in order to help the *da`wah* workers to easily understand the Orang Asli's life in more detail. As an example, Ramlee Abdullah et al.'s (2014) study proves that the jungle is considered like a 'bank' for the Orang Asli where in it is kept the livelihood of the Orang Asli community. In line with this Haliza (2010) also finds that the Orang Asli community observe the ethics when they deal with the mother nature. In the study it is proven that their belief, practice and way of life encourage them to take care of the forest and the environment. Siti Aminah's (2015) study also finds that Orang Asli have a strong belief that the forest is the main source of livelihood and it will continue to provide sustenance to the Orang Asli from generation to generation. Looking at the function of the forest, it is transpired in the life of Orang Asli. Therefore, missionary workers must understand this phenomenon and understand also the reason why they are overwhelmingly reliant on the forest.

In the communication process, Zulkefli & S. Salahuddin (2016) explain that this is the first thing to consider before planning to do *da`wah* work. In other words the *da`wah* workers have done prior research and obtain the information about the life and lifestyle of the Orang Asli community before they embark on the *da`wah*. This is in line with the statement by Muhammad Sholikhin (2013) who says that in the context of *da`wah*, the *da`wah* workers must take into consideration the aspect of the community that is muti-ethnic in nature in order to ensure that the communication process is effective. Zulkefli et al. (2014) states that this method is an inter-cultural *da`wah* communication process i.e. the effort of the *da`wah* workers to understand the culture of their *mad$^{c}$u* (i.e those who become a target group as well as a receiver of the messege of *da`wah* from *da`wah* worker).

The conclusion is that at the initial stage to form *da`wah* communication it involves the communication methods (used by the *da`wah* workers) which are verbal and non-verbal. The verbal communication of the *da`wah* workers can be seen when they greet the Orang Asli with "salam", the wish of "selamat sejahtera" or "greetings to all", and when they are shaking hands with them. Meanwhile the non-verbal communication is referring to the facial

expressions of the *da`wah* workers that is they smile when they are meeting the Orang Asli. In line with Zawiyah's (2009) statement that says facial expressions are a person's non-verbal language that can give out all sorts of meaning in its delivery. Therefore, the *da`wah* workers' effort to learn the socio-cultural aspect and the lifestyle of the Orang Asli community is imortant because the language that is used in the process of communication is capable of influencing the feelings of the the Orang Asli community.

2. The Strategy in Initiating the Communication Form for *Da`wah*

Fariza et al. (2000) explains that the preparation involes the process of identifying the goals, the target group, challenges to be encountered and strategies used by the *da`wah* workers in achieving the *da`wah* mission. In their effort to form *da`wah* communication, Ab. Aziz (2001) explains that *da`wah* delivery covers two components. The components are the methodology and the strategy that suits the target group. It is explained further that the *da`wah* workers must know what the content of the *da`wah* is so that it can suit the method of delivering the *da`wah* message. Similarly, Amien Wibowo (2015) too explains that the planning is also part of the strategy of *da`wah* communication in order to achieve the objective of spreading the message of Islam.

The finding from the study also reveals that PK 1 also makes a strategy by introducing the concept of 'Mentor Mentee' to the Orang Asli community. PK 1 expalins that a *da`wah* worker must consider himself/ herself as a 'Mentor' when conveying the *da`wah*. However, the 'Mentor' that is meant here does not have the complete authority to control the Orang Asli community. On the flip side, they workers must always be prepared and be cautious with every action that they take.

Meanwhile for PK 4 the strategy used is by getting acquainted with the people who have strong influence in the Orang Asli community for example the Tok Batin, village head and the Village Security and Development Committee (the term used among Malaysian is *Jawatankuasa Kemajuan Keselamatan Kampung* or JKKK). He explains that if the *da`wah* workers have a good relationship with this group of people, their presence in the village is more welcomed by the people there. Furthermore, the local inhabitants are more willing to accept what is said by the *da`wah* worker when they see that the Tok Batin or Orang Asli village headmen, and JKKK welcome the presence of the *da`wah* worker. This kind of effort eases the work of the *da`wah* worker in building the communication and relationship with the locals. Ma'rof & Sarjit (2008) explain that the village head of Orang Asli is appointed through two ways i.e. inheritance and appointment. The selection is done depending on the credibility of the individual in the Orang Asli community. Thus, the strategy of approaching the influential people in the community is necessary because in the study (Johari & Nazri 2006; Colin et al. 2010) it is found that the Orang Asli practice the obedience system in their daily life. This kind of lifestyle has become the practice from generation to generation and it is their ancestral tradition. Therefore, this situation makes the position of the Tok Batin one who is respected and constantly becomes the source of reference of the local people.

Besides that, the research finding also shows that the *da`wah* workers strategize in terms of lexical choice and the content of coversation when communicating with the Orang Asli community.This is agreed by PK 1 , PK 2, PK 3, PK 6 and PK 8 who also add that besides being cautious with the lexical choice and the content of coversation, ethics and manners of the *da`wah* worker are also important in influencing and inviting Orang Asli to get closer to Islam. The research finding explains that the wearing of *jubah* (robe) is not suitable when entering the Orang Asli village. This is because it can make the Orang Asli feel uncomfortable. This is in line with Juli Edo's (1988) study that indicates that the influence and believe towards the supernatural power shapes the social life of the Orang Asli and this covers values, attitudes and personality, taboos and customs. In addition to that Mohammad Aslam et al.'s (2004) study shows that the strong belief moulds the community's culture. The factor of holding on to the customs and culture exposes the character and social life of the Orang Asli who are always careful in life. Therefore, it is not strange to see that the Orang Asli community are concerned about ethics to ensure that they will not do anything that is against their customs and culture that is integral in their life.

In addition to that, the research finding also indicates that PK 5 and PK 7 make a preparation by attending related courses to learn the languages of the Orang Asli. Even though the Orang Asli community in Selangor are able to understand and to speak in Bahasa Melayu, the *da`wah* workers' capability to master the language of the orang Asli gives them a positive image among the Orang Asli. The study by Sa'adiah (2014) finds that the Che Wong tribe that is made up of groups of Orang Asli from the Senoi community use their own language more when

they are communicating among themselves as compared to using Bahasa Melayu. The same thing is also found in Zuriatunfadzlia et al.'s (2009) study shows that the Bateq tribe are still not affected by changes especially in terms of language even though they are experiencing cultural changes due to the emergence of eco-tourism. The research finding shows that the preservation of the usage of the Orang Asli language is through the communication link with family members, neighbours and the people in the community. This indicates that they are preserving their language identity even though their population is small and they are only a minoriy people. The need for a *da`wah* worker to learn the Orang Asli languages, even only minimally, is necessary because with the language it gives an advantage to the dakwah workers when they want to engage the Orang Asli (Halim & Zulkefli, 2014).

From the aspect of planning to build a communication connection with the Orang Asli, the research finding shows the various efforts done by the *da`wah* workers to get closer to the Orang Asli community. The efforts are through the practice of mentor-mentee concept in learning, the effort to approach the influential individuals in the Orang Asli community, the strategy of choosing the words to be used in the content of coversation, the observance of ethics and appropriate manners as a *da`wah* worker and finally attending related courses to learn the language of the Orang Asli. In the context of *da`wah*, Bassamul ᶜUmush (2005) says that it is a process (التأليف قبل التعريف or wining the heart of *mad`u* first before explaining the Islamic terminologies) of trying to learn about the background of the *madᶜu* in much detail in order to get to know them a lot better.

3. Types of Topics of Conversation in *Da`wah* Communication

al-Bayanuni (2010) explains that the tenets of *da`wah* is basically made up of three aspects which are *daᶜie*, *madᶜu* and *mawduᶜ* (content) of *da`wah*. In the aspect of *mawduᶜ* of dakwah, it is explained that it discusses all aspects that relate to *da`wah*, *aqidah* (belief) and *syariah* (Islamic law). According to Asep (2013) the content of *da`wah* refers to the information and messages that invite human to accept the *syariah*. It is further explained that the discussion process carried out will create a form of *da`wah* communication between the *da`wah* worker as the source of information and the target group as the recipient of the message. Therefore, as the outcome of the interviews with the *da`wah* workers it shows that the topic of conversation in this study can be divided into two aspects i.e. *da`wah* knowledge and general knowledge.

i. Knowledge of *Da`wah*

The knowledge of *da`wah* is the knowledge and information that leads man to the way of Allah (Kustadi, 2013). It is further explained that knowledge is divided into two i.e. *da`wah* knowledge and general knowledge. Meanwhile, according to Sohirin (2008), the knowledge of *da`wah* that is also known as the science of *da`wah* can be defined as knowledge which through it can be known the means of conviction and whether the means is in the form of sayings such as preaching and teaching or lecturing or the means in the form of behaviour such as giving good example, beneficial work, as well as the good account of life. However, in this study, the konwledge of *da`wah* refers to the content of *da`wah* itself that delivered by the *da`wah* workers to their *mad`u*. Therefore, in this study, the result of the interviews reveal that PK 1, PK 2 and PK 6 explains that the Orang Asli community are very likely to ask about one thing that they consider difficult to do for example *solat* (prayers), *wudhu* (ablution), fasting and *khitan* (circumcision). These practices are considered difficult to adopt considering the lifestyle of Orang Asli who never practiced them before they learned about Islam. Mohd Nizam & Che Zarrina's (2005) study also identifies the push factors among the Orang Asli that make them difficult to accept acts of worship like *khitan* (circumcision), fasting, halal diet and difference in culture also contributes to this. They find it difficult to perform acts of worship because they are not used to them as they have never done them before. This situation makes them distance themselves from Islam because they consider it as a burden in life.

Moreover, the study also discovers that according to PK 4 and PK 5, it is usually the *da`wah* workers who have to initiate the discussion on the topics about Islam when conversing with the Orang Asli. However, the *da`wah* workers explain that they cannot really say whether or not the Orang Asli community truly understand the message of Islam communicated to them. This is due to their attitude that is they prefer to stay silent while the teaching and learning process is carried out. Below is the statement by PK 4:

> "…in my experience teaching this man, he always keeps silent. When we ask him whether he understands or not, he replies that he understands .But when we ask him a question he can't answer. He actually doesn't understand. What it means here is that he is just imitating what we say".
>
> (PK 4: 53-59)

Nazariyah's (2014) study finds that the character of the Orang Asli children, the environment, diet, interests, education and parents' influence are shaping their attitude that is one that does not pay attention to matters pertaining to religion and also education in their daily life. Because of this they do not want to ask questions and as a consequence the *da`wah* workers are not sure whether the message conveyed is understood or not. The research finding also shows that the same sentiment is shared by PK 8 who portrays the Orang Asli as merely 'pessengers' in their class. The following is the statement:

> "…There are those who are merely pessengers in the class. Well, they listen only. Whether they understand or not they don't seem to show. It's impossible for us to understand them. We do not know whether they understand or not. We know that they are shy and if there is anyone among them that might ask questions, he or she must be someone with a career (i.e. has education). What we tell them they understand, but when we ask them back they cannot answer".
>
> (PK 8:133-137)

However, refusal to ask questions is not something strange when it comes to conveying *da`wah* to Orang Asli. This attitude is synonymous with the Orang Asli community. Based on the research by Doris et al. (2012) it is found that the Orang Asli community are imbued with prejudice due to their natural character that is shy and they have low self-esteem when they are around outsiders. Besides that, the study by Mohd Johdi et al. (2009) finds that the level of awareness among Orang Asli is still low. This is due to a few factors like attitude, family and their surroundings. As a result of this, as discovered in Abdul Sukor et al.'s (2011) study that shows the Orang Asli community has weak memory and this causes them unable to master the 3M skills i.e. writing, reading and arithmetic. These factors stop them from asking about something or from being curious about Islam.

The research finding tells the experience of the *da`wah* workers in their effort to approach this group and it has been discovered that the main factors as to why it is difficult to communicate the message of *da`wah* to the orang Asli are their shyness and low self-esteem. According to the *da`wah* workers, these factors make them reluctant to ask questions although the *da`wah* message conveyed is not clearly understood by them. This is in line with the finding of the study conducted by Ahmad et al. (2009) that shows Orang Asli are known to have shy and modest character. Doris (2012) explains that Orang Asli do not freely expose themselves in public and because of that they are prejudiced towards the general public. W.A Amir Zal's (2013) study calls this 'social capitalisme' that is they have community connection according to their own way of life.

ii. General Knowledge

Unlike matters related to general knowledge, the issues of assistance, welfare and the behaviour of the Muslim community constantly become the main questions asked by Orang Asli to the *da`wah* workers. From the study it is found that PK 3, PK 6, PK 7 and PK 8 make similar statements that is Orang Asli always question the attitude and the negative actions of the Muslim community. More seriously considering that there are some Muslims who do irresponsible things like stealing, not minding their words, not looking after their manners, drinking, traficking and pushing drugs, entering the village of Orang Asli without permission, raping and even staying together with Orang Asli women outside of wedlock. All these create a bad image of Muslims among the Orang Asli community. This situation becomes a challenge to the *da`wah* workers who have been given the special task in the Orang Asli villages. The research finding also shows that, based on the statements of the *da`wah* workers, there are some inhabitants who do not welcome the presence of the *da`wah* workers whenever they hear the word "*ustaz*" (religious teacher) being used. This situation explains why it is not something odd to hear Orang Asli have the impression that by being converted to Islam they are also directly being turned into Malay.

In line with the study by Syed Abdurrahman (2009) that finds Orang Asli equate the Malay community with Islam. However, the negative attitude displayed by the Malay community creates a negative perception among

the Orang Asli about Muslims. As a consequence, Orang Asli believe that by being converted to Islam they are becoming Malay (Zulkefli & Halim 2014; Padzal 1997; Ramlee Abdullah 1988).

Besides that, from the research it is also found that the questions asked by the Orang Asli to the *da`wah* workers are characteristically unpredictable. This demands the *da`wah* workers to possess skills to answer the questions and to ensure that the orang Asli are convinced with the the answers given. PK 2 shares the experience concerning the question posed by the Orang Asli to him:

> "some examples of the questions: we are old, if we convert to Islam, can we avoid being circumcised? What more we are diabetic… Then, like when I was teaching yesterday, there was one Orang Asli asked me about the different types of crying. Meaning how many types. It was difficult to research and find answer to the question. I answered 10 types of crying. This crying is due to pain, happiness, sadness and crying because one sees another person crying. Can you see that? These questions asked by Orang Asli sometimes are very unpredictable. They are something else".
>
> (PK 2: 14-27)

The following is the question asked to PK 4 who confesses that he had to really think about what was the most appropriate answer before he gave the answer to the Orang Asli who posed the question:

> "Like in the topic about *solat* (prayers) he asked why do we need to first say the intention. Why not start the prayer with *Takbir*? This is common. Maybe he was thinking why it was like that…".
>
> (PK 4: 78-80)

The same also with the explanation by PK 8 who considers the questions asked are challenging and difficult to answer spontaneously. This is in order to ensure that the answer given is accurate and appropriate, and can be accepted by the Orang Asli community according to their level of understanding:

> "When it comes to the topic on death, they'd ask you what the life will be like after death. So it's quite a challenge to answer , right?"
>
> (PK 8: 35-37)

From the finding of the research, it shows that there are some *da`wah* workers who are not prepared to answer questions posed spontaneously. This is due to they are not able to anticipate the questions asked by the Orang Asli community and because of that they need time to find the answer that can convince the Orang Asli. Therefore, *da`wah* workers must be more prepared when they face with questions from the Orang Asli. *Da`wah* workers' preparation is important so that every answer they give is true, easy to understand and can be accepted and can convince the Orang Asli community.

Conclusion

Overall, the research findings show that the types of da`wah communication to the Orang Asli community involve three main stages i.e. the initiation stage, strategizing and topics of conversation during communication. Every element has its role and influence that can affect the *da`wah* work carried out by PMOA and PDM towards the Orang Asli community. For *da`wah* workers who are proactive and can perform multiple skills that suit the current situation, their communication with the Orang Asli can lead to something positive and their presence in the village is welcome by the Orang Asli community. However, the *da`wah* workers must be more prepared to answer questions asked by the Orang Asli so that they will accept and can be convinced by every answer given by the *da`wah* workers. The research finding concerning the initiation stage, strategizing and topics of conversation show that *da`wah* workers are utilizing all sorts of methods in order to approach the Orang Asli community. However, every approach taken by PMOA and PDM is different because it must suit the community in which they are doing their dakwah. This is because every Orang Asli settlement has certain unique features. Therefore, this situation requires for effort and skills on the part of the *da`wah* workers to learn about the background and lifestyle of the locals.

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