Volume 1 | Number 1 | November 11th, 2013 | ARO ISSN: 2307-549X | DOI: 10.14500/2307-549X

ARO

The Scientific Journal of Koya University

Issue Highlights

KOYA UNIVERSITY
aro.koyauniversity.org

ARO; The Scientific Journal of Koya University

The Aro ("Today" in Hewramí Kurdish), is an international scientific journal published by the Koya University with ISSN: 2307-549X and DOI: 10.14500/2307-549X. Aro is a journal of original scientific research, global news, and commentary. The Aro Scientific Journal is a peer-reviewed, open access journal that publishes original research articles as well as review articles in all areas of Science.

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ARO

The Scientific Journal of Koya University

Vol I, No 1(2013)

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DOI: 10.14500/2307-549X ARO ISSN: 2307-549X

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Aro Editorial Words

It was less than a year ago when the Koya University Council (KUC) decided to separate its official University Journal (Govarí Zankoy Koye) into two separate publications. A journal treating topics in humanities and social sciences to be produced in hard copies in Kurdish and Arabic, while a solely electronic journal in English dedicated to abstract and applied sciences. Our group were assigned the task of selecting an appropriate title, assembling an editorial board, and creating an editorial policy on reviews and submissions. The title selected for the latter journal was Aro, Kurdish for "today".

Aro is now borne as a peer-reviewed, open source online scientific publication. It is the fruit of great scholarly effort and editorial endeavor by the members of our academic community and the newly formed editorial board of the Journal. We would like to thank all members for their tireless support.

Aro was created with a long-term aspiration of becoming a credible regional and international scientific publication, accessible to all in Kurdistan and beyond, and covering a wide range of scholarly disciplines in sciences. The focus of the journal is to reflect that of the Koya University, namely promoting scientific knowledge and research in Kurdistan. We aspire for Aro to become a channel for exchange of research and scholarship by established and aspirant academics and researchers in Kurdistan and worldwide.

The warm response from researchers, academics and professionals made our task of creating an editorial Board a relatively easy one. It is clear that having a dedicated and well organized editorial board for the journal is only one side of the coin. The other is the ability to attract submissions of quality research and scholarly work. We are thankful to all of those who put their trust in Aro and presented their original research work and review articles for publication in the premier issue of the journal. Standards of submissions were flexible for the first issue. However, a robust review process has been put in place to ensure a high quality publication based on international norms and standards.

We strongly hope that submission of works and articles, high in quantity and quality, continues, as this is the only guarantee for the survival of Aro as a worthy alternative to costly international publications. We at the Editorial Board hope to publish Aro in a semi-annual format, with the hope of expanding its frequency into a quarterly journal in the future.

Your support and feedback are invited and appreciated.

Sincerely,

Professor Khidir M. Hawrami
Executive Publisher

Dilan M. Rostam, Shwan K. Rachid, Salah I. Yahya, Sarkawt S. Abdulrahman
Executive Editorial Board

DOI: 10.14500/2307-549X ARO ISSN: 2307-549X

ARO ISSN: 2307-549X DOI: 10.14500/2307-549X

Effects of Seeding Density and Nitrogen Fertilizer on the Productivity of Egyptian Clover

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Abstract—**The study was carried out to show the effect of different levels of nitrogen fertilizer 0, 20, 40 and 60 kg urea/ha, and two seeding rates 15 and 30 kg/ha. The study was conducted at Bakrajo research field during the winter season 2011-2012 to some growth characteristics of Egyptian clover, such as plant height, dry leaf weight percent, dry stem weight percent, leave stem ratio, fresh yield t/ha, dry yield t/ha and dry matter percent. The experiment was designed as (R.C.B.D). The results can be summarized as follow; significant differences were observed between all three cuts, and the third cut was superior in almost characters especially in the forage yield. The application of 40 and 60 kg urea gave maximum yield. Using 15 kg seeds/ha showed superior value due to fresh yield in compare to 30 kg for all cutting, while the dry yield responded non-significantly to seeding rates.**

***Index Terms*—Clover, Nitrogen fertilizer, Seeding density.**

I. Introduction

Berseem clover probably originated in Syria and was introduced into Egypt during the 6th century (Hannaway and Larson, 2004). Morocco adopted Berseem in the beginning of the 20th century and had about 50.000 ha, in the "Irrigated perimeters", in 2005 (Merabet, et al., 2005) Berseem sown in mixture with oats or ryegrass smothers weeds during establishment and regrowth after oats harvest (Clark, 2008). However, total replacement of animal protein with high Berseem protein concentrate levels 17.5% led to reduced performance even with aminoacids supplementation (Bhowal, Cherian and Das, 2011). Trifolium alexandrium L. commonly known as Berseem or Clover is an important leguminous winter fodder crop. It is appreciated as a forage crop due to its high protein content, soft leaves, tender stem, high leaf to stem ratio and also rapid growth. Berseem is an N-fixing legume. It may require rhizobium inoculation outside its native area (Hackney, Dear and Crocker, 2007). Berseem can be mixed with 20% ground corn and provide high quality silage (SuePea, et al., 2000) Berseem hay appears to have a nutritive value equivalent to alfalfa hay and may completely replace this classical forage in balanced diet (Gaafar, El-Lateif and El-Hady, 2011). First cutting is ready after about 45 days of sowing and subsequent cuttings may be taken at 30-35 days intervals during winter and at 25-30 days intervals in spring and summer. The seed yield of Berseem mainly depends upon the time of last cut for green fodder and leaving it for seed production. The last cutting should be taken relatively early in low humidity and late in high humidity conditions (Mohsen, et al., 2011). Optimum fertilizer-N rates depended strongly on target levels for NUE, amounts of unrecovered N, growth period and DM yield of herbage. Calculations showed that target DM yield of herbage and growth period per cut are essential in estimating the effect of applied N on marginal N response, NUE and amounts of unrecovered N. The highest yield of protein with a relatively low yield of fiber is obtained by cutting the plant at a height of about 40 cm (Chauhan, Gupta and Chopra, 1992). To obtain higher yield of good quality fodder, mix 2-3 kg seed of rye grass per acre with full seed rate of Berseem. Mix some moist soil with rye grass seed and broadcast it evenly. Then broadcast Berseem seed, rake the field and irrigate immediately (Dairy Farm Guide, 2013).

II. Material and Methods

The present study conducted at Bakrajo research field, Faculty of Agriculture of Science University in Sulamania, during the winter season of the year 2011-2012. The investigation was conducted to study the impact of four rates of nitrogen fertilizer 0, 20, 40 and 60 kg urea/ha under two seeding rates of 15 and 30 kg seeds/ha for Egyptian clover. The experiment was seeded on Nov. 13th, 2011. Three successive cutting were obtained across the season (5/4 – 15/4

ARO, The Scientific Journal of Koya University
Volume I, No (1)2013, Article ID: ARO.10017, 6 pages
DOI: 10.14500/aro.10017
Received 03 June 2013; Accepted 21 July 2013
Regular research paper: Published 11 November 2013
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 http://dx.doi.org/10.14500/aro.10017

– 17/6). The experiment was laid out according to randomized complete back design with three replications (SuePea, et al., 2000). Each replication contains 8 plots of 8 rows with four meters long and 25 cm apart rows. Six rows were harvested for each cut. Study characters, plant height, and dry leaf weight percent dry stem percent, leave stem ratio, fresh yield t/ha, dry matter percent. All data were statically analyzed at %5 significant level for each cutting according to the methods of analysis various (ANOVAs). List significant difference (L.S.D) at 5% significant level was used to compare between mean characters. The aim of the study is determine the best plant density and nitrogen level application to produce maximum fresh and dry forage yield for Berseem clover.

III. Results and Discussion

Data in Table I confirms the presences of significant differences between fertilizer applications levels. The application of 40 and 60 kg urea/ha exceeded the treatment of control by 17.52 and 22.47% respectively, while no significant difference were represent between the levels 40 and 60 kg/ha, and also between the treatment of control no application and 20 kg urea/ha maximum fresh yield recorded by the application of 60 kg urea/ha, which was 6.185 t/ha. The minimum fresh yield value was 5.050 t/ha recorded by the treatment of control. The same trend was observed due to dry yields in which the application of 60 kg urea/ha produced maximum dry yield 0.763 t/ha and exceeded the application of 0 and 20 kg urea/ha by 36.0 and 20.15% respectively. All application levels predominated the treatment of control for dry yield characters no significant differences between the application of 40 and 60 kg urea/ha in dry yield. Maximum value recorded by the application of 60 kg urea/ha which was 0.763 t/ha, while the lowest value produced by the treatment of control which was 0.561 t/ha.

TABLE I
Effect of Fertilized (FER) Levels on Forage Yield in First cut

Fer.	Fresh yield t/ha	Dry yield t/ha	D.M %
0	5.050	0.561	11.107
20	5.285	0.635	12.037
40	5.935	0.734	12.380
60	6.185	0.763	12.367
L.S.D ($p \leq 0.05$)	0.288	0.038	0.325
L.S.D ($p \leq 0.01$)	0.400	0.053	0.451

From the same table significant differences between fertilizer application levels were observed due to the character dry matter percent. All application levels exceeded the treatment of control by 8.37, 11.46 and 11.34% respectively. There were not significant differences between the application of 40 and 60 kg urea/ha, maximum dry matter value was 12.380% recorded by the application of 40 kg urea/ha, while the lowest value was 11.107% showed by the treatment of control.

From Table II significant difference between fertilizer application levels was observed for fresh, dry yield and dry matter percent during the second cut. The application of 60 kg urea/ha showed maximum fresh yield 8.262 t/ha in which exceeded the treatment of control and 20 kg urea/ha significantly by 14.43 and 8.31 % respectively due to higher accumulation of dry matter by application nitrogen fertilizer. There was no significant difference between the levels 40 and 60 kg urea/ha, all application levels predominated the treatment of control in which produced the lowest value of fresh yield with 7.22 t/ha.

From the same table it was found that all application levels pre-dominated the treatment of control due to the character dry yield by 8.19, 16.76 and 22.47% respectively. Maximum dry yield value was 1.286 t/ha produced by the application level of 60 kg urea/ha, while the lowest dry yield value was 1.050 t/ha recorded by the treatment of control. Data in the same table explained the effect of fertilizer levels in dry matter percent, which affected significantly. The application of 60 kg urea/ha gave maximum dry matter percent 15.612%, while the treatment of control showed the lowest percentage of dry matter 14.542%. All applications pre-dominated the treatment of control by 3.06, 5.59 and 7.36% respectively (Al-Mohammad, et al., 2011).

TABLE II
Effect of Fertilizer Levels on Forage Yield of the Second Cut

Fer.	Fresh yield t/ha	Dry yield t/ha	D.M %
0	7.220	1.050	14.542
20	7.628	1.136	14.987
40	8.028	1.226	15.355
60	8.262	1.286	15.612
L.S.D ($p \leq 0.05$)	0.389	0.049	0.142
L.S.D ($p \leq 0.01$)	0.540	0.068	0.198

Data represented in Table III showed significant effect of fertilizer application in fresh, dry yield and dry matter percent. Regarding to fresh yield the application of 40 kg urea/ha gave maximum yield in which out yielded both 0 and 60 kg urea/ha significantly. There were no significant differences between 20 and 40 kg urea/ha in this character and between 0 and 60 kg urea/ha. Concerning to dry yield as shown in the same table the application of 40 kg urea/ha out yielded the rest significantly , with the exception of 20 kg urea/ha minimum dry yield recorded by the treatment of control with 1.394 t/ha.

As shown in the same table, maximum dry matter percent produced by the application of 40 kg urea/ha which was 18.733% and followed by 60 and 20 kg urea/ha with 18.497 and 18.407% respectively. All application levels exceeded the treatment of control significantly for this character. Minimum dry matter percent is exhibited by the treatment of control with 17.908%.

TABLE III
EFFECT OF FERTILIZED (FER) LEVELS ON FORAGE YIELD DURING THIRD CUT

Fer.	Fresh yield t/ha	Dry yield t/ha	D.M %
0	7.798	1.394	17.908
20	8.210	1.510	18.407
40	8.298	1.552	18.733
60	7.972	1.475	18.497
L.S.D ($p \leq 0.05$)	0.304	0.054	0.421
L.S.D ($p \leq 0.01$)	0.422	0.074	0.584

Data in Table IV explained the effect of fertilizer application level in some growth characters for the first cut. Regarding to dry leaf weight percent which respond significantly to fertilizer applications , the application of 40 kg urea/ha showed maximum percent with 71.833% in which exceeded both 0 and 20 kg urea/ha while it was differed with 60 kg urea/ha non significantly, the lowest dry leaf weight percent produced by the treatment of control with 68.5%.

Regarding to dry stem, weight percent as presently in the same table exhibited maximum value due to this character with 31.5% in which exceeded the rest significantly. Minimum value of dry stem weight percent produced by the application of 60 kg urea/ha, which was 28.167%. Leaf stem ratio, from the same table it was observed that the characters leaf stem ratio estimated as dry weight respond significantly to fertilizer application during the first cut . The application of 40 kg urea/ha produced maximum ratio which was 2.550 and followed by 60 kg urea/ha with 2.475 the lowest ratio exhibited by the treatment of control 1.818 (Mohsen, et al., 2011).

TABLE IV
EFFECT OF FERTILIZED (FER) LEVELS ON GROWTH CHARACTERS DURING FIRST CUT

Fertilizer	Plant height cm	Dry leaf wt.%	Dry stem wt.%	Leaves /stem ratio
0	23.167	68.500	31.500	1.818
20	27.167	70.167	29.833	2.188
40	2.873	71.833	28.167	2.550
60	37.667	71.167	28.833	2.475
L.S.D ($p \leq 0.05$)	1.549	0.721	0.721	0.692
L.S.D ($p \leq 0.01$)	2.150	1.001	1.001	n.s

As shown in Table V, the characters dry leaf weight, dry stem weight percent and leaf stem ratio were respond to fertilizer application significantly during the second cut. Regarding to leaf dry weight percent the application of 40 kg urea/ha produced maximum value 58.00% , and exceeded both 0 and 20 kg urea/ha significantly. While it differs none significantly with 60 kg urea/ha, the treatment of control showed the lowest value 53.33%. Concerning to dry stem weight percent the treatment of control gave maximum value 46.667% and exceeded both 40 and 60 kg urea/ha but there were no significant different between 0 and 20 kg urea/ha and also between 40 and 60 kg urea/ha. Regarding to the character leaf stem ratio for the second cut, the application of 40 kg urea/ha produced maximum ratio 1.407 in which out yielded both 0 and 20 kg urea/ha significantly no significant differences were represent between 40 and 60 kg urea/ha. The lowest ratio was 1.147 recorded by control.

TABLE V
EFFECT OF FERTILIZED (FER) LEVELS ON GROWTH CHARACTERS DURING SECOND CUT

Fertilizer	Plant height cm	Dry leaf wt.%	Dry stem wt.%	Leaves /stem ratio
0	47.833	53.333	46.667	1.147
20	55.500	55.500	44.500	1.253
40	5.873	58.000	42.000	1.407
60	70.167	57.167	42.833	1.373
L.S.D ($p \leq 0.05$)	2.449	2.362	2.362	0.152
L.S.D ($p \leq 0.01$)	3.399	3.278	3.278	0.211

From Table VI significant effect of fertilizer applications was observed in growth characters during the third cut. The application of 60 kg urea/ha gave maximum dry leaf weight percent 45.833%, and exceeded the treatment of control significant differences were recorded between 20, 40 and 60 kg urea/ha. The maximum value recorded by the treatment of control with 43.5%. Data on dry stem weight percent for the third cut represent in the same table the treatment of control with 56.05% gave maximum ratio while the application of 60 kg urea/ha showed the lowest ratio 54.05%. The character leaf stem ratio estimated during the third cut showed different values due to fertilizer application leaves. Maximum ratio was 0.843 recorded by the application of 60 kg urea/ha, while the treatment of control showed the lowest ratio 0.767.

TABLE VI
EFFECT OF FERTILIZED (FER) LEVELS ON GROWTH CHARACTERS DURING THIRD CUT

Fertilizer	Plant height cm	Dry leaf wt.%	Dry stem wt.%	Leaves /stem ratio
0	49.333	43.500	56.500	0.767
20	57.333	45.000	55.000	0.815
40	6.270	45.000	55.000	0.813
60	66.667	45.833	54.500	0.843
L.S.D ($p \leq 0.05$)	2.704	0.838	0.979	0.029
L.S.D ($p \leq 0.01$)	3.753	1.164	1.359	0.040

Data in Table VII explain effect of seed rate in forage yield during the first cut. The effect of seeding rate was found to be

 http://dx.doi.org/10.14500/aro.10017

significant for fresh yield and dry matter percent only. Using 15 kg seeds predominated 30 kg in fresh yield, while using 30 kg seeds exceeded 15 kg in dry matter percent.

TABLE VII
EFFECT OF SEED RATES ON FORAGE YIELD IN FIRST CUT

Seeding Rates kg	Fresh yield t/ha	Dry yield t/ha	D.M
15	5.839	0.673	11.500
30	5.388	0.674	12.445
L.S.D (p≤0.05)	0.204	n.s	0.230
L.S.D (p≤0.01)	0.283	n.s	0.319

Data in Table VIII explains the effect of seeding rates in forage yield during the second cut. This effect was significant in fresh yield and dry matter percent only with the same trend as shown in the first cut (DAIRY FARM GUIDE, 2013).

TABLE VIII
EFFECT OF SEED RATES ON FORAGE YIELD IN SECOND CUT

Seeding Rates kg	Fresh yield t/ha	Dry yield t/ha	D.M
15	8.325	1.189	14.238
30	7.244	1.160	16.010
L.S.D (p≤0.05)	0.275	n.s	0.101
L.S.D (p≤0.01)	0.382	n.s	0.140

Table IX shows the effect of seeding rate forage yield during the third cut which showed the same trend with the first and the second cut (Mohsen, et al., 2011).

TABLE IX
EFFECT OF SEED RATES ON FORAGE YIELD IN THIRD CUT

Seeding Rates kg	Fresh yield t t/ha	Dry yield t/ha	D.M
15	8.413	1.505	17.892
30	7.726	1.460	18.881
L.S.D (p≤0.05)	0.215	n.s	0.298
L.S.D (p≤0.01)	0.298	n.s	0.413

Data represented in Table X explains in the effect of seeding rate in some growth characters. During the first cut the effect of seeding rate was significant weight only for the character dry leaf weight percent, exhibiting the predominance of 15 kg seeds in compare to 30 kg seeds.

Table XI shows a significant effect in all study characters. Using 15 kg seeds recorded maximum value for dry leaf weight percent and leaf stem ratio 59.58% and 1.492% respectively, while the seeding rate of 30 kg exceeded 15 kg in dry stem weight percent recording 47.583%.

TABLE X
EFFECT OF SEED RATES ON GROWTH CHARACTERS FIRST CUT

Seeding Rates kg	Plant height cm	Dry leaf wt.%	Dry stem wt.%	Leaves / stem ratio
15	28.083	70.833	29.167	2.170
30	31.000	70.000	30.000	2.346
L.S.D (p≤0.05)	1.096	0.510	0.510	n.s
L.S.D (p≤0.01)	1.521	n.s	n.s	n.s

TABLE XI
EFFECT OF SEED RATES ON GROWTH CHARACTERS SECOND CUT

Seeding Rates	Plant height cm	Dry leaf wt.%	Dry stem wt.%	Leaves / stem ratio
15	56.250	59.583	40.417	1.492
30	61.333	52.417	47.583	1.098
L.S.D (p≤0.05)	1.732	1.670	1.670	0.107
L.S.D (p≤0.01)	2.403	2.318	2.318	0.149

Data in Table XII shows significant effect of seeding rates in all growth characters for the third cut with the same trend of the second cut.

TABLE XII
EFFECT OF SEED RATES ON GROWTH CHARACTERS THIRD CUT

Seeding Rates	Plant height cm	Dry leaf wt.%	Dry stem wt.%	Leaves / stem ratio
15	57.250	45.833	54.333	0.843
30	62.333	43.833	56.167	0.776
L.S.D (p≤0.05)	1.912	0.593	0.692	0.020
L.S.D (p≤0.01)	2.654	0.823	0.961	0.028

TABLE XIII
EFFECT OF INTERACTION BETWEEN FERTILIZATION LEVELS AND SEED RATES IN FORAGE YIELD CHARACTERS SEEDING RATES/FERTILIZER FIRST CUT

F x S	Fresh yield t/ha	Dry yield t/ha	D.M
0 x 15	5.260	0.571	10.840
0 x 30	5.540	0.649	11.707
20 x 15	5.933	0.705	11.887
20 x 30	6.623	0.766	11.567
40 x 15	4.840	0.550	11.373
40 x 30	5.030	0.622	12.367
60 x 15	5.937	0.764	12.873
60 x 30	5.747	0.760	13.167
L.S.D (p≤0.05)	0.407	n.s	0.460
L.S.D (p≤0.01)	n.s	n.s	n.s

Data in Table XIII explains the effect of interaction between fertilization levels and seed rate in some forage yield characters, confirming significant interaction on the characters fresh yield and dry matter percent only at level 5% (Das and Singh, 1999). Regarding the characters fresh yield, maximum value recorded by the interaction between the application of 20 kg urea/ha associated with 30 kg seeding rate which was 6.623 t/ha, while the lowest value recorded by the interaction between 40 kg urea/ha nitrogen application under 15 kg seeding rate. Concerning to dry matter percent , it was observed that the association between application of 60 kg urea/ha with 30 kg seeding rate recorded maximum dry matter percent which was 13.167% the minimum value was 10.840% recorded by the interaction between zero application under 15 kg seeding rate.

Data in Table XIV confirms the presence of significant effect of interaction between fertilization levels and seeding rate during the second cut on forage yield characters. Maximum fresh and dry yield were 8.917 and 1.338 kg/ha respectively recoded the association between application of 20 kg urea/ha with 30 kg/ha seeding rate, while the lowest value was 7.173 and 0.967 t/ha respectively. For the interaction between zero applications associated with 15 kg seeds/ha, maximum dry matter percent was 16.25 % recorded by the interaction between the application 60 kg urea/ha under 15 kg seeds/ha, while the lowest dry matter percent was 13.483% recorded by the interaction between zero application of nitrogen and 15 kg seeds/ha.

TABLE XIV
EFFECT OF INTERACTION BETWEEN FERTILIZATION LEVELS AND SEED RATES IN FORAGE YIELD CHARACTERS SEEDING RATES/FERTILIZER SECOND CUT.

F x S	Fresh yield	Dry yield	D.M
0 x 15	7.173	0.967	13.483
0 x 30	8.410	1.178	14.007
20 x 15	8.800	1.272	14.460
20 x 30	8.917	1.338	15.000
40 x 15	7.267	1.133	15.600
40 x 30	6.847	1.093	15.967
60 x 15	7.257	1.179	16.250
60 x 30	7.607	1.233	16.223
L.S.D ($p \leq 0.05$)	0.550	0.069	0.201
L.S.D ($p \leq 0.01$)	0.763	0.096	0.279

The interaction effect between fertilizer application and seeding rates was found to be significant for fresh and dry yield during the third cut, Table XV. The interaction between the application of 20 kg urea associated with 15 kg seeds/ha gave maximum fresh and dry yield 8.747 and 1.594 t/ha respectively , while the lowest fresh and dry yield was 7.190 and 1.319 t/ha respectively recorded by the interaction between the application 40 kg urea/ha with 15 kg seeding rates.

TABLE XV
EFFECT OF INTERACTION BETWEEN FERTILIZATION LEVELS AND SEED RATES IN FORAGE YIELD CHARACTERS SEEDING RATES/FERTILIZER THIRD CUT.

F x S	Fresh yield	Dry yield	D.M
0 x 15	8.407	1.468	17.477
0 x 30	8.633	1.555	18.007
20 x 15	8.747	1.594	18.233
20 x 30	7.867	1.404	17.850
40 x 15	7.190	1.319	18.340
40 x 30	7.787	1.465	18.807
60 x 15	7.850	1.510	19.233
60 x 30	8.077	1.546	19.143
L.S.D ($p \leq 0.05$)	0.430	0.076	n.s
L.S.D ($p \leq 0.01$)	0.597	0.105	n.s

Data in Table XVI confirms the presence of significant interaction between fertilizer application and seeding rate during the first cut for dry leave weight percent and dry stem weight percent.

TABLE XVI
EFFECT OF INTERACTION BETWEEN FERTILIZATION LEVELS AND SEED RATES IN GROWTH CHARACTERS FIRST CUT.

F x S	Plant height	Dry leaf wt.%	Dry stem wt.%	Leaves/ stem ratio
0 x 15	22.667	69.667	30.333	1.567
0 x 30	23.667	71.000	29.000	2.117
20 x 15	25.667	72.667	27.333	2.660
20 x 30	28.667	70.000	30.000	2.337
40 x 15	28.000	67.333	32.667	2.070
40 x 30	32.333	69.333	30.667	2.260
60 x 15	36.000	71.000	29.000	2.440
60 x 30	39.333	72.333	27.667	2.613
L.S.D ($p \leq 0.05$)	n.s	1.020	1.020	n.s
L.S.D ($p \leq 0.01$)	n.s	1.416	1.416	n.s

Data in Table XVII explains the interaction effect between fertilization and seeding rates during the second cut for some growth characters in which respond significantly to this effect. Regarding to dry leaf percent maximum value was 62.333% obtained by the association between both interactions 20 kg urea fertilizer with 15 kg seeding rate and the interaction 20 kg urea with 30 kg seeding rate, while the lowest value was 51.333% exhibited the interaction between 40 kg urea with 15 kg seeding rate.

Data in Table XVIII concerning to the interaction effect between fertilizer levels and seeding rate in growth characters for the third cut. The character dry stem weight responds significantly to interaction effect only. Maximum dry stem weight was found for the interaction effect between 40 kg urea coupled with 15 kg seeding rate which was 58.00% while the

 http://dx.doi.org/10.14500/aro.10017

lowest value was 53.667 exhibited by the interaction between the treatment zero nitrogen and 30 kg seeding rate (Gaafar, El-Lateif and El-Hady, 2011).

TABLE XVII
EFFECT OF INTERACTION BETWEEN FERTILIZATION LEVELS AND SEED RATES IN GROWTH CHARACTERS SECOND CUT.

F x S	Plant height	Dry leaf wt.%	Dry stem wt.%	Leaves/ stem ratio
0 x 15	45.000	55.333	44.667	1.240
0 x 30	50.667	58.333	41.667	1.400
20 x 15	53.333	62.333	37.667	1.660
20 x 30	57.667	62.333	37.667	1.667
40 x 15	60.333	51.333	48.667	1.053
40 x 30	63.000	52.667	47.333	1.107
60 x 15	66.333	53.667	46.333	1.153
60 x 30	74.000	52.000	48.000	1.080
L.S.D ($p \leq 0.05$)	n.s	3.340	3.340	0.215
L.S.D ($p \leq 0.01$)	n.s	n.s	n.s	n.s

TABLE XVIII
EFFECT OF INTERACTION BETWEEN FERTILIZATION LEVELS AND SEED RATES IN GROWTH CHARACTERS THIRD CUT

F x S	Plant height	Dry leaf wt.%	Dry stem wt.%	Leaves/ stem ratio
0 x 15	46.000	45.000	55.000	0.813
0 x 30	52.667	46.333	53.667	0.860
20 x 15	53.667	45.667	54.333	0.837
20 x 30	61.000	46.333	54.333	0.863
40 x 15	63.667	42.000	58.000	0.720
40 x 30	68.000	43.667	56.333	0.770
60 x 15	65.667	44.333	55.667	0.790
60 x 30	67.667	45.333	54.667	0.823
L.S.D ($p \leq 0.05$)	n.s	n.s	1.384	n.s
L.S.D ($p \leq 0.01$)	46.000	n.s	n.s	n.s

IV. CONCLUSION

Clover forage yield was significantly greater at the third cut due to more plant growth such as plant height and more dry matter accumulation across the time, while at the first cut the forage yield was decreased due to more moisture content and the plants were not reached the suitable height for cut. There were not obvious trend of forage yield due to seeding rates because the space between plants within each rows were constant for each seeding rates. This makes the competition between plants will occurs within rows not between rows.

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Modernization Theory and House Garden Transformation; Erbil City as Case Study

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***Abstract*—Recently, the concept of modernity and its influences on global warming comes to be a common topic in architectural debates. The disappearance of gardens in the contemporary house layouts generated a need for new approaches to create a sustainable network of green areas within residential neighborhoods. The objectives of this paper intend to emphasize on the holistic phenomenon of house garden transformations. The rationale behind selecting cases inside Erbil city, Iraq return to its historical background which passed through rapid transformations due to the political, economic, and cultural changes. This paper aims to identify reason behind disappearance of house gardens in new developments. Moreover, it describes the physical elements of local traditions in different periods. The analytical methodology used in this paper relies on four different periods of the city evolution. It discusses the building garden visual elements in terms of architectural physical factors. The study emphases on two types of analyses, the morphology analyses for each period individually, and comparative analyses between different periods. The findings of this paper will indicate the crucial factors that affecting the disappearance of house garden as well as the general positive effects of vegetation in urban contexts.**

***Index Terms*—Erbil City, House Garden, Modernity, Morphology, Transformation.**

I. INTRODUCTION

What is a House Garden?

Gardens can be considered as the mirror of house's architectural identity. It's a plane outdoor space that arranges a part for the display, cultivation, and enjoyment of plants and other forms of nature as defined by Turner (2005) A garden is "a piece of ground fenced off from cattle, and appropriated to the use and pleasure of man: it is, or ought to be, cultivated". The etymology of the word refers to enclosure, as defined by the oxford English dictionary" The term refers to an enclosed area of land, usually adjoining a building." House Garden is an image of life, as explained by (Easton, 2007) that at the core of the garden, further than concepts like landscape, and plantings, lies a state of constant modification .It means that garden formulate a powerful sentimental experience that raises our drive to explore more and more.

Planting of vegetative material within a house (Gardens) is an action of landscaping, which is usually playing an important role in softening the environment (Wilson, 1984). The presence of vegetation within the house layout will enhance the quality of life, a sense of calmness, and reducing the stressful life conditions (Sheets and Manzer, 1991; Herzog and Chernick, 2000; Kuo, Bacaicoa and Sullivan, 1998; Sullivan et al., 2004). Hence, urban residential areas that are rich in gardens will create comfortable places for living.

II. MODERNIZATION THEORY: REVIEW STAGE

One of the most influence factors on the issue of green architecture and landscape design is the global warming because the climate change has the potential to cause many effects on the landscape. Modernity as an origin of globalization is one of the vital factors in global warming. Recently there has been a rethinking in contemporary social and cultural theory of the concept of modernity; the most impressive source for its manifestation is technology, which is a restless and accelerating process of transformation (Baper et.al, 2010). For most architects technology means the fundamental tools for modernization. On the other hand the continuous technical progress in science and technology feeds as motivators to introduced new dimensions to the social life and a regular change to the traditional cultures. Therefore, technology is a part of civilization and the art of life. It is a broad concept that deals with knowledge of tools and crafts, and how it affects a species' ability to control and adapt to its environment (Rasoul, 2003).

For Habermas modernization theory is an analysis and evaluation of modern forms of social life. It indicates the social, political, cultural and psychological circumstances that

ARO, The Scientific Journal of Koya University
Volume 2013, Article ID: ARO.10024, 7 pages
DOI: 10.14500/aro.10024
Received 22 August 2013; Accepted 04 October 2013
Regular research paper: Published 11 November 2013
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http://dx.doi.org/10.14500/aro.10024

occur from certain historical procedures (Baper and Hassan, 2010). Modernization theory according to Habermas's historical analysis, leads to the liberation of subjects from traditional roles and values. In this regards, Froomkin (2003) argues that the society organization is considered as Habermas's central question of modernity (how society should be organized); it means the justification of social choices in a world of fundamental moral equal opportunity. Habermas's title completely makes two points. First, modernity is a project and second, it's a continual project which have not completed. In order to introduce the important account of House garden modernity as a part of society organization, it is useful to explore in detail morphological analysis of house garden evolution through time.

III. House Garden Transformation in Erbil City

Throughout its 6,000 years of urban civilization, the Erbil city architectural tradition has been categorized by architectural principles that highlighted the building with nature, Fig. 1. In order to crystallize house garden landscape modernity categories in Erbil city, and for the purpose of data collection, the study will divide the periods of Erbil city evolutions into four categories.

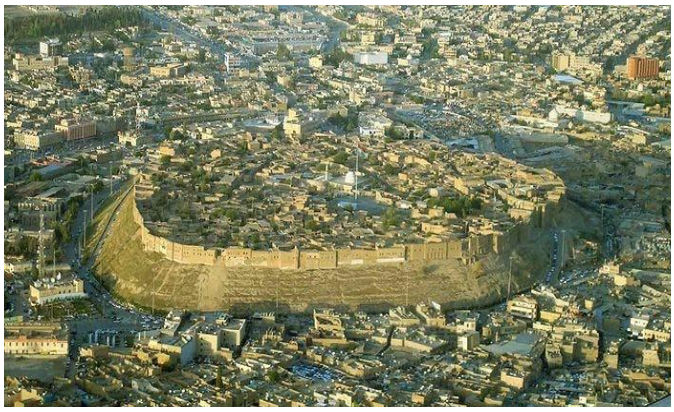


Fig. 1. Erbil Citadel City

A. Traditional Period Before 1930 (Pre-Modern Period)

Traditional ancient city of Erbil, (Fig. 2 – first and second stage) is one of the oldest continuously inhabited urban settlements in the world. The distinctive architectural and landscape features of the ancient city can be recognized as a vast complex of buildings and narrow streets enclosed by town walls. In this regards HCECR (2009) explains that the citadel town of Erbil is largely occupied by traditional courtyard houses reached through a maze of narrow alleyways. There are just over 502 dwellings; most of them are courtyard houses of mud walls, short span timer roofs and mud roofing. The average area of the house is up to 140 m². The Citadel courtyard which is usually enclosed formulates the most affectionate and secure of outdoor spaces, for its most related space between outside environment and the house. Some of the citadel courtyards have a unique tiny effusive fountain, Fig. 3. In spite of its limited area, it gives the feeling of warmth, shelter, and comfort. They provide the most soft environment transformation between the house and outside atmosphere.

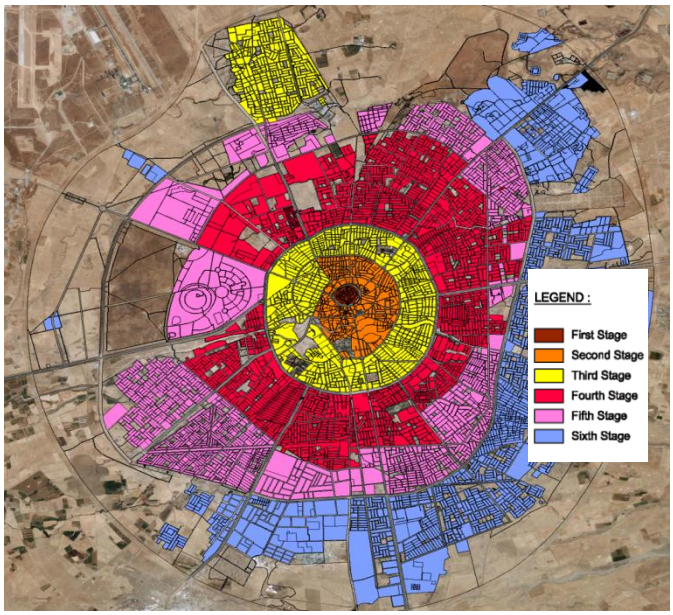


Fig. 2. Historical Development of Erbil City. Source: Erbil City Master Plan Report, 2007.

B. Modification Period (Colonial Period) (1930-1980)

In the early twentieth century (Fig. 2- third & fourth stage), especially after Britain occupations a modern city was introduced as an instrument of colonial control. The industrial capitalism and its social and cultural effects provide the basis for notions of the modern. New houses and other buildings started to be built within the lower town, in a new and distinctive style indicating a major departure from the tradition. Hence the concept of modern city means the city of the automobile with the planned streets. In this sense, HCECR (2009) explains Furthermore, these new system provide the possibility for using the large external windows with glass imported from abroad, new paving tiles, doors, and plaster decorations. However, the internal courtyard continued to be used until it was totally discarded in the 1950s and was replaced by a new style of front garden as a mode of western culture.

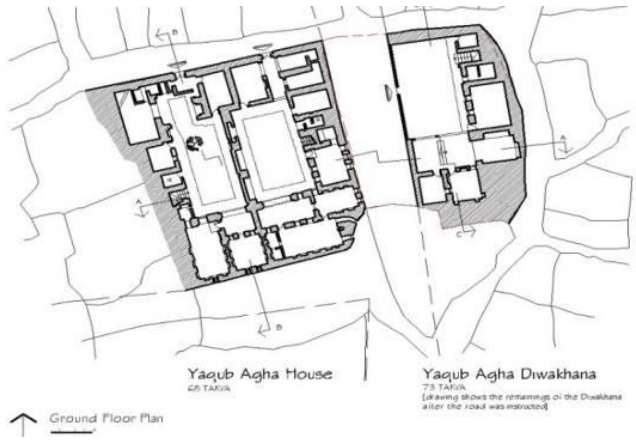
C. Transitional Modernity Period (1981-2003)

During this period Iraq has been subjected to years of sanctions, war and destruction. Erbil city was influenced by political conflicts in the region. Huge rural migrations towards large cities have been noticed. These rural migrations into urban centers eventually required some kind of urbanized built

environment to accommodate them (Chadirji, 1986). As a result, rural builders who were migrants themselves took the situation into their own hands and imbued the cities with their own concept of urbanization, accordingly large outer spaced gardens, Fig. 4, where produced.

This condition led to an extreme polarization in the production of architecture in Erbil city, Fig. 2, fifth stage. On one hand it reflected the need to construct thousands of housing units for low income inhabitants. The land divisions ranged mostly between 200 and 300 m^2 due to bad economic conditions in this period. The range of the built area was small comparing to the left open space that was used for garden.

(a)



(b)

Fig. 3. (a) A Courtyard in Erbil citadel interior view, and (b) Ground floor plan.

D. Advanced Modernity Period (After 2003)

After liberation of Iraq in 2003, architecture in Erbil City has gone through major changes and passed through rapid transformations due to economic developments, (Fig. 2, sixth stage). Consequently, Peace, relative prosperity, and democracy began to grow in the region (Gunter., 2004). This period can be considered as golden era of the city evolution. Many of development projects have been constructed and the urbanization process reached its climax. The rapid growth of the construction and housing sector led to a state of contradiction in the architectural forms. Strange ideological orientations penetrated into the body of traditions. Most of the housing development projects reflected western concepts and passed over the local traditions. These approaches generate a state of confusion in architectural identity, Fig. 5. The rapid economic developments create new lifestyle which affected the house build area as a result of new functional requirements. As well as the concept of subdivision of a plot of land was the main reason of decreasing the garden area.

Fig. 4. Large gardens in the transitional period (1981-2003).

Fig. 5. Houses without garden after 2003.

IV. Research Methodology

Visual morphology analysis aims to understand the spatial structure and character of house garden by analysis of physical structures at different scales. The analysis will focus on how the physical form of house garden changes over time. Accordingly, comprehensive checklist factors have been designed to establish an appropriate model for understanding. For the purpose of the study, the Morphology analysis will investigate the most important parameters (dimensions), then assigning each parameter by a range of relevant values.

The methods used for data collection contained a visual characteristics analysis survey using the (morphology checklist survey forms). Furthermore, the surveys enhanced by a photographic study to record and document each housing Garden. The documentation procedure includes house garden

 http://dx.doi.org/10.14500/aro.10024

details such as garden type, Geometry, Garden Permeability, materials, etc. The essential reason in conducting this survey aims to construct a mixed matrix form to illustrate the different levels of similarity and diversity between house gardens in one hand as well as to determine the significance of elements and features, whether viewed separately or collectively in the other hand.

For the purpose of this study, samples of ninety six house gardens were selected (an average of twenty four samples in each period). Sample selection based on house garden's importance which have been constructed during the specified period and its familiarity, in addition to its semantic richness and diversity.

V. Findings

The Morphology analysis produced the following results:-

A. *Type of Gardens*

1. Pre-modern period: Results show (Table I) that 83.4% of the cases have (courtyard open spaces) while 16.6% of cases have no gardens or open spaces at all. Moreover, there are no indications for other types of gardens.
2. Modernity Period (1930-1980): front garden is the most popular type in this period as an average of 87.5% while 8.3% of cases are back yard gardens.
3. Transitional Modernity Period (1980-2003): front garden is still dominant in this period as a rate of 79.1% of cases, while anew style of courtyards gardens appeared as an average of 12.5%.
4. Advanced Modernity Period (After 2003): results show that front garden started to disappear as an average of 20.8% , while a strong trend of houses with no gardens appeared as an average of 62.5% of the cases.

TABLE I
Types of Gardens in Different Periods of Erbil City Evolution

Periods Of Erbil City Evolutions	Sample size(n)	Roof Garden	Front Garden	Back yard Garden	Courtyard Garden	Patio Garden	Window boxes G.	No Garden
Traditional (before 1930)	24				20			4
Modernity (1930-1980)	24		21	2		1		
Transitional 1980-2003)	24		19	1	3			1
Advanced (after 2003)	24	1	5		1	1	1	15
Total	96	1	45	3	24	2	1	20

B. *Geometry of Gardens*

1. Pre-modern period: Results show that non- Regular Geometrical shape is the most dominant shape with an average of 70.8%, with a low average of 12.5% for the regular Geometrical shape and there are no indications for other geometric shapes in this period (Table II).
2. Modernity Period (1930-1980):A new style of regular geometric shape of gardens started to appear strongly with an average of 91.6%,while the non-regular geometric shape rate minimized with an average of 8.4%.
3. Transitional Modernity Period (1980-2003): the style of regular geometric shape is still dominant in this period with an average of 87.5%, while a new type of curvature shape gardens appeared with an average of 8.3%.
4. Advanced Modernity Period (After 2003):Due to the disappearance of house gardens in this period, the rate of 25% of remaining gardens are of geometric shape, and 12.5% of curvature shape.

TABLE II
Types of Geometry of Gardens in Different Periods

Periods Of Erbil City Evolutions	Sample size(n)	Regular Geometrical shape	Non-regular Geometrical shape	Curvature shape	Flexure shape	Mixed (geometry and non-geometry)	No Garden
Traditional (before 1930)	24	17	3				4
Modernity (1930-1980)	24	22	2				0
Transitional (1980-2003)	24	21		2			1
Advanced (after 2003)	24	6		3			15
Total	96	66	5	5			20

C. *Garden Permeability with Street*

Results in Table III show that house garden permeability with street in pre-modern period is full solidity without any transparency to external spaces as an average rate of 100%. While in second period a number of cases appeared to be semi solid as a rate of 25%, in third Period the concept of full solidity dominate all cases. Finally in Fourth Period a new approach appeared to add transparency to house garden as an average of 8.4%.

TABLE III
Garden Permeability with Street in Different Periods

Periods Of Erbil City Evolutions	Sample size(n)	Full solidity	Semi solidity	Neutral	Semi-transparency	Full transparency	No Garden
Traditional (Before 1930)	24	20					4
Modernity (1930-1980)	24	18	6				0
Transitional 1980-2003)	24	23					1
Advanced P. (After 2003)	24	6		1		2	15
Total	96	67	6	1	0	2	20

D. *Garden Materials*

Hard materials is the dominant concept of house garden in first period as an average of 70.8% while 12.5% of garden

material are mixed between hard and soft materials. In the second period Soft materials dominates 79.1 % of cases and 20% of cases are mixed between hard and soft materials. In third Period, soft materials continued to be the dominant features of house garden as an average of 91.6%. Finally, in the fourth period, the concept of hard material returns to the manifestation as a rate of 8.3% of total cases and 25% of cases is still focusing on soft materials in house gardens, Table IV.

TABLE IV
GARDEN MATERIALS IN DIFFERENT PERIODS

Periods Of Erbil City Evolutions	Sample size(n)	Soft materials	Hard materials	Mixing hard and soft materials	No Garden
Traditional (Before 1930)	24		17	3	4
Modernity (1930-1980)	24	19	4	1	
Transitional 1980-2003)	24	22		1	1
Advanced P. (After 2003)	24	6	3		15
Total	96	47	24	5	20

E. Ratio of Garden Area to Plot Area

The ratios of house garden to the plot area of houses, Table V, are as follow:

TABLE V
RATIO OF HOUSE GARDEN IN DIFFERENT PERIODS

Periods Of Erbil City Evolutions	Sample size(n)	Less than 10%	(10-25)%	(25-50)%	More than 50%
Traditional (Before 1930)	24	3	16	5	
Modernity (1930-1980)	24	2	6	15	1
Transitional 1980-2003)	24		7	17	
Advanced P. (After 2003)	24	18	4	2	
Total	96	23	33	39	1

Garden Location within the Plot of Land

Results in Table VI shows that 83.3% of cases in the first period are located in the centre of the plot (courtyard) .while in the second period 70.8% of cases are located in the front, 16.7% in the front and sides and only 8.3% are located at the back of the plot. The idea of front garden is strongly adapted in the third period as a rate of 87.5%. In the final stage all available garden are located at the front of house inclusively.

Garden Size

Gardens in the first period are medium and large in size in relation to result findings that 33.3% of cases are medium and 50% of cases are large (more than 20 m^2) in size. In the second and third periods results show that garden size are large in size as an average of 75%, and 83.4% respectively. Whereas in the final stage the garden size return to be small in size as an average of 37.5% or disappeared totally as a rate of 62.5% of total cases, Table VII.

TABLE VI
TYPES OF GARDENS IN DIFFERENT PERIODS

Periods Of Erbil City Evolutions	Sample size(n)	Front Garden	Side Garden	Back Garden	All around	Centre (court yard)	Front and back	Front and side	No Garden
Traditional (Before 1930)	24					20			4
Modernity (1930-1980)	24	17		2		1		4	
Transitional (1980-2003)	24	21						2	1
Advanced P. (After 2003)	24	9							15
Total	96	47		2		21		6	20

TABLE VII
SIZE OF GARDENS IN DIFFERENT PERIODS

Periods Of Erbil City Evolutions	Sample size(n)	Small less ≤ 10m2	Medium (10-20)m2	Large ≥20m2	No Garden
Traditional (Before 1930)	24		8	12	4
Modernity (1930-1980)	24	2	4	18	
Transitional 1980-2003)	24		3	20	1
Advanced P. (After 2003)	24	9	0	0	15
Total	96	11	15	50	20

Garden Accessibility From House

In the first period, Results in Table VIII shows that the accessibility to all courtyard gardens is direct access as a rate of 70.8% and access via arcades is 8.3%.while in the second period the direct accessibility reduced to 62.5% at the same time accessibility via in between spaces and entrance lobby decreased to 20.8% and 16.6% respectively.

In the third period, 83.3% of cases indicate direct accessibility to house gardens. Finally in the fourth period results show that only 16.7% of cases are in a condition of direct accessibility with manifestation of new types of accessibilities from patio.

 http://dx.doi.org/10.14500/aro.10024

TABLE VIII
GARDEN ACCESSIBILITY IN DIFFERENT PERIODS

Periods Of Erbil City Evolutions	Sample size(n)	Direct access to garden	Access via in-between spaces	Access via arcades	Access via patio	Access via entrance lobby	No Garden
Traditional (Before 1930)	24	17	1	2			4
Modernity (1930-1980)	24	15	5			4	
Transitional (1980-2003)	24	20	1			2	1
Advanced P. (After 2003)	24	4	1		3	1	15
Total	96	56	8	2	3	7	20

VI. CONCLUSIONS

The morphological analysis of house garden in different periods of Erbil city evolution produced following facts:

a. House garden is a project to create a comprehensive and sustainable network of green areas .it aims to connect house units within urban context in a manner of environmental behavior.
b. House garden is considered to be one of the most important kinds of vegetation for house enclosure. It aims to reduce energy consumption, by bringing the landscape into the house for shade, air quality and energy saving, as well as it intends to enrich bio diversity environments to improve the psychological and physical health of inhabitants. This conclusion to be or become identical with (Sullivan, Kuo, and DePooter 2004) concepts that an increase in trees and grass is positively correlated with the amount and character of social interactions in urban spaces.
c. The regularity of house garden in a geometric shape translated the mode of modernity in comparison with non-geometric shape of traditional period .it's the influence of modernity forces on local tradition.
d. Courtyards are the common type of gardens in traditional period. It provides space, light and a quantity of greenery for social and private activities. While in other periods house garden emphases on green area and tress for psychological aspects.
e. In spite of the bad impression of modernity on local traditions, the concept of green area within the plot of land was one of the benefits of colonial period. This concept translated to house front garden and created the environmental softening for urban context.
f. The garden permeability with street in most cases is considered as (Full solidity) .this idea is a translation of Islamic approach toward inside looking and can be considered as a mode of privacy.
g. The size of house garden works as an in-between space to separate the house from the street. The new division of house lands according to municipality regulation as well as the new functional requirements in recent period is main factors in reducing house gardens size which affected the privacy of inhabitants.
h. The simplicity of garden material and urban compact pattern arrangements indicates the simplicity of people and the role of Islamic religion in dissemination of the idea of unity, humility and simplicity among the Neighborhoods.
i. The new functional requirements of modern life style (Social factors) and owning more than one vehicle by family members (Economical factors) affected the garden size (to be small or disappeared totally) .Moreover, it reduced the ratio of garden area (open spaces) to house build area. These transformations have a direct impact on global warming and energy conservation.
j. Direct access to house garden is a translation of Kurdish society toward nature. This issue can be considered as enhancement towards green architecture.
k. The second and third periods of Erbil City Evolution indicate that most of house gardens are front gardens in a grid iron pattern of row houses. The juxtapositions of these gardens will create a green belt and enhance the concept of green infrastructure within urban context.

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 http://dx.doi.org/10.14500/aro.10026

Unity Energy Response Using CaSO4:DY/Teflon

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***Abstract*—This study investigates the possibility of achieving unity energy response using the very sensitive CaSO4:Dy/Teflon thermoluminescent detector at photon energies below 100 keV. Accurate measurements for the energy responses were carried-out using ultra thin, 3 micron thick, TLD discs with average grain size of about 3μm. The present work shows that the experimental reduction factor for the 15 % phosphor loading with average grain size of 3 μm is in good agreement with the calculation based on the cavity theory but at grain size of 1.0 μm. This indicates that the cavity theory is underestimating the real experimental reduction factor in the energy response. The present work expect that unity energy response can be achieved with grain size of about 1 μm.**

***Index Terms*— Cavity Theory, Energy Response, Particle Size, Photon Energy.**

I. Introduction

In the study of radiation effect on human, there are special circumstances in which dosimeters having unity response (energy independent), good spatial resolution, and high sensitivity are required. This permits measurement to be made over cellular dimensions. The use of radiations for treatment of cancer is well established and widespread. A large number of hospitals have radiotherapy facilities. For accurate measurement of exposures to patients, a sensitive tissue equivalent dosimeter is needed. Among many types of thermoluminescent detectors (TLD), $CaSO_4$:Dy is one of the most sensitive, although it has a major disadvantage that its energy response is a complex function of both photon energy and phosphor grain size (Chan and Burlin, 1970; Pradhan and Bhatt, 1970; Driscoll and McKinlay, 1981; Pradhan and Bhatt, 1982; Silva 1989; Carlson, et al., 1990; Kasa 1990; Hemandez and Rivera Et Al., 2012). According to the cavity chamber theory (Chan and Burlin, 1970), if a detector such as a TLD placed inside a medium of different properties, the energy response ($\boldsymbol{L}$) of the detector becomes a complex function of the energy lost by the electrons and that is imparted by the interaction of photons with the TLD (Karali, et al., 2009; Olko, et al., 2006), which is given by;

$$L = \frac{D_m}{D_c} = dS_{m,c} + (1-d)(\frac{\mu_{en}}{\rho})_{m,c} \quad (1)$$

Where, D_m & D_c are the radiation dose in the medium and in the cavity, d is a weighting factor, function of the cavity size, $S_{m,c}$ is the electron stopping power ration of the medium to the cavity, and $(\frac{\mu_{en}}{\rho})_{m,c}$ is the photon mass energy absorption coefficient ratio of the medium to the cavity. The weighting factor (d) is defined as;

$$d = \frac{1-e^{-\beta L}}{\beta L} \quad (2)$$

Where, β, is the electron attenuation coefficient and is related to the electron range through;

$$e^{-\beta R} = 0.01 \quad (3)$$

It was shown that the weighting factor (d**)** decreases from one to zero with increasing cavity size.
For small cavity, energy absorption by photon interaction in the cavity becomes very small.

$$d \sim 1 \quad and \quad (1-d) \approx 0 \quad (4)$$

Therefore, the response equation reduced to;

$$L \approx S_{m,c} \quad (5)$$

As cavity size increased;

$$d \sim 0 \quad and \quad (1-d) \approx 1 \quad (6)$$

Therefore, the response equation reduced to;

$$L = (\frac{\mu_{en}}{\rho})_{m,c} \quad (7)$$

Calculation of the energy response was carried out according to the cavity theory for phosphor having large grain size, 5 µm grain size, and for 1.0 μm grain size.

ARO, The Scientific Journal of Koya University
Volume 2013, Article ID: ARO.10026, 3 pages
DOI: 10.14500/aro.10026
Received 26 August 2013; Accepted 24 October 2013
Regular research paper: Published 11 November 2013
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We believe that reducing grain size can control the energy response of the TLD at photon energies below 100 keV.

II. Material and Method

The aim of this work is to achieve unity energy response using a very sensitive CaSO4:Dy/Teflon detector at photon energies below 100 keV. This can be done by varying phosphor grain size and the percentage loading of the phosphor in Teflon. CaSO4:DY powder of grain size ~75 μm is re-treated by milling and sieving in our laboratory to achieve average grain size of 3.0 μm. Two TLD rode having phosphor loading of 30% and 15% by weight were manufactured by incorporating the TLD phosphor into a Teflon powder, heated, and molded into a TLD rod. Slices of pre-selected thickness of 3 μm TLD discs are cut by means of microtome. At the beginning the micro-discs are soft and difficult to handle. This problem is overcome by sandwiching the discs between two micro-slide glasses in an oven at a temperature of 280 ^{0}C for two hours. The micro-discs become rigid and more easily to be handled with vacuum tweezers. Direct measurement of the thickness of the micro-discs with a standard digital micrometer yields values of $3 \pm 0.5\ \mu m$. The thickness is also checked using a Mercer digital metric gauge unit type 122D. An average value of $3 \pm 0.5\ \mu m$ is assumed for all discs.

The radiation beam was directed perpendicularly to the surface of an approximately cylindrical phantom of Teflon plastic, see Fig. 1.

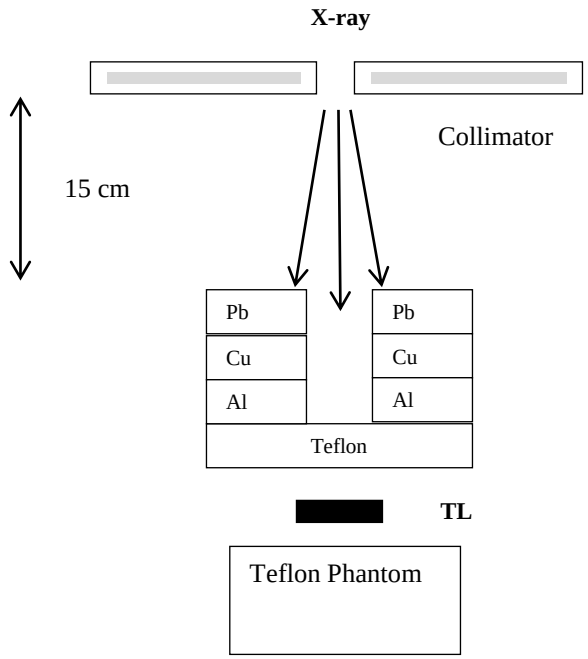

Fig. 1. The irradiation arrangement to measure the energy response.

The entrance field, symmetrically situated on the phantom surface, was 1.0 cm diameter and was defined by means of a special mask made of, lead, copper, aluminum, and Teflon. The mask was arranged so that the material nearest to the detector was the material with the lowest k-edge. Thus, the incident spectrum progressively degenerated to negligible proportions in the graded absorber. Thus, the incident spectrum progressively degenerated to negligible proportions in the graded absorber. The micro discs were placed on the top of the Teflon phantom.

Measurements of the energy response were carried-out using 90 discs for both phosphor loadings using filtered x-ray spectra having effective energies from 30 keV to 80 keV. The effective energy was checked using the half-value-layer method. All discs are irradiated with 0.1 Gy photon dose. The discs light out-put were normalized to that for Co-60 gamma source energy.

III. Results and Discussion

Fig. 2 shows the calculated and the measured energy response of CaSo4:Dy surrounded by Teflon material. The average grain size in the present experimental work is 3 µm.

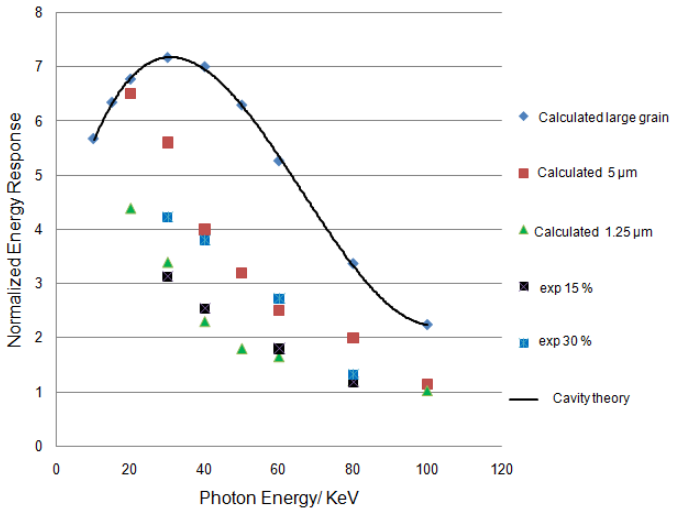

Fig. 2. The energy response of CaSO4:Dy/Teflon normalized to Co^{60} energy.

It is shown from the figure that the experimental energy response for the 15 % loading is in good agreement with the cavity theory calculation for the 1.0 µm grain size.

Cavity theory usually based on the assumption of single crystal of CaSO4:Dy surrounded by Teflon which is not the case in practice. In practice, large crystal is crushed to very small sized crystals, but small crystals tend to agglomerate and stick with each other by electrical forces developed during milling and sieving. Therefore, decreasing the percent phosphor loading in the TLD rode helps to separate the small grain from each other. Extra reduction in the energy response is therefore expected if the experimental problem can be overcome. Fig. 3 shows the reduction factor in the energy response for both phosphor loadings at different photon energies.

http://dx.doi.org/10.14500/aro.10026

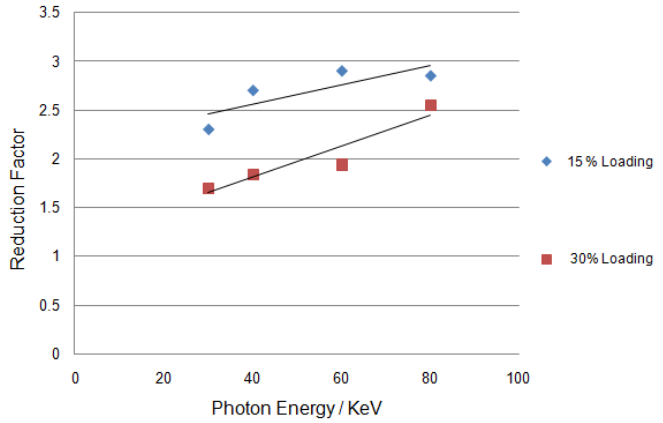

Fig. 3. The experimental reduction factor in the energy response of CaSO4:Dy/Teflon at different photon energies and phosphor loadings.

It is observed that the reduction factor for the 15% phosphor loading is greater than that for 30% phosphor loading, and this reduction increases with increasing photon energies.

Table I shows the measured energy response with its standard error compared with the cavity theory calculations at different x-ray qualities.

TABLE I
THE MEASURED AND CALCULATED ENERGY RESPONSE OF CASO4:DY/TEFLON AT DIFFERENT PERCENT LOADING AT DIFFERENT EFFECTIVE PHOTON ENERGIES

Photon Energy (keV)	Calculated (Large grain)	Calculated (5 µm)	Calculated (1.25 μm)	Experimental ± SD 15 % loading	Experimental ± SD 30% loading
10	5.68				
15	6.35				
20	6.78	6.5	4.6		
30	7.18	5.6	3.3	3.13±0.3	4.22±0.35
40	7.01	4.0	2.5	2.54±0.32	3.80±0.35
50	6.30	3.2	1.8		
60	5.25	2.5	1.5	1.8±0.31	2.7±0.30
80	3.37			1.18±0.25	1.32±0.30
100	2.24	1.37	1.3		

IV. CONCLUSION

From the above discussion one can conclude that calculations based on the cavity theory are underestimating the real experimental energy response, and the general trends of the calculation agree with the experiment but with higher energy response value. Therefore Unity energy response can be achieved with grain size of about 1 μm.

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Tin Oxide Nanoparticles: Synthesis, Characterization and Study their Particle Size at Different Current Density

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***Abstract*—Tin oxide nanoparticles are prepared by electrochemical reduction method using tetrapropylammonium bromide (TPAB) and tetrabutylammonium bromide (TBAB) as structure directing agent in an organic medium *viz.* tetrahydrofuran (THF) and acetonitrile (ACN) in 4:1 ratio by optimizing current density and molar concentration of the ligand. The reduction process takes place under an inert atmosphere of nitrogen over a period of 2 h. Such nanoparticles are prepared by using a simple electrolysis cell in which the sacrificial anode as a commercially available in tin metal sheet and platinum (inert) sheet act as a cathode. The parameters such as current density, solvent polarity, distance between electrodes and concentration of stabilizers are used to control the size of nanoparticles. The synthesized tin oxide nanoparticles are characterized by using UV–Visible, FT-IR and SEM–EDS analysis techniques. UV-Visible spectroscopy has revealed the optical band gap to be 4.13, 4.16 and 4.24 ev for (8, 10 and 12 mA/cm^2) and the effect of current density on theirs particle size, respectively.**

***Index Terms*— Band gap, Electrochemical cell, Tetrabutylammonium bromide (TBAB), Tetrapropylammonium bromide (TPAB), Tin oxide nanoparticles.**

I. Introduction

Tin oxide is an important n-type semiconductor material with a band gap of 3.6 ev. It has been widely used in many applications such as optoelectronic devices (Kim, et al., 2002) fabricating solar cells (Moustafid, et al., 2002; Okuya, et al., 2001) electrochemical applications (Chen and Liu, 1999), electrode materials for Li-ion batteries (Kim, et al., 2005), catalysts for redox reactions (Chou, et al., 2003; Wierzchowski and Zatorski, 2003) and gas sensors (Moulson and Herbert, 1990; Li, Zhang and Kawi, 1999). Due to its high sensitivity to reduce as well as to oxidize gases, SnO_2 has been used as the predominant sensing material in the field of solid-state gas sensors for environmental monitoring of CO, H_2, and NO.

The large surface area of SnO_2 allows more surface to be available for CO adsorption and the subsequent desorption of CO_2, which in turn would allow for an increase in its sensitivity (Sharp, et al., 1998; Farrukh, Heng and Adnan, 2010). Nanosized SnO_2 could enhance the sensor performance because of its microstructural characteristics and electronic properties. In this work, I have synthesized SnO_2 nanoparticles by electrochemical reduction method because this method has several advantages such as high yield, easy isolation and simple control of size particles by adjustment of the current density.

II. Experiment

The synthesis of tin oxide nanoparticles by electrochemical reduction method for narrow size distributed metal nanoparticles. Cluster size was found to decrease with an increase in current density. This process has been used with two inexpensive electrodes to setup 50ml electrolyte solutions in which sacrificial anode consist of the bulk metal transformed into metal clusters. The supporting electrolyte consists of (TPAB and TBAB), each has served as a stabilizer for the metal clusters in different current density.

Thus in overall process the bulk metal is oxidized at the anode, the metal cations migrate toward the cathode and reduction will take place with the formation of metal or metal oxide in the zero oxidation state.

At anode $Sn^0 \rightarrow Sn^{2+} + 2e^-$

At cathode $Sn^{2+} + 2e^- \rightarrow Sn^0$

At anode tin (Sn^0) is oxidized from zero oxidation state to Sn^{+2} due to the potential difference between both electrodes. The metal cations (Sn^{+2}) migrated from anode electrode to cathode electrode where the reduction took place with the formation of tin (Sn^0) or tin oxide (SnO_2) in the zero oxidation state. Agglomeration with the formation of undesired metal

ARO, The Scientific Journal of Koya University
Volume I, No (1)2013, Article ID: 10028, 5 pages
DOI: 10.14500/aro.10028
Received 08 September 2013; Accepted 08 October 2013
Regular research paper: Published 20 November 2013
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http://dx.doi.org/10.14500/aro.10028

powders is prevented by the presence of ammonium stabilizers. Initially, a tin sheet (1×1 cm) as an anode and a platinum sheet (1×1 cm) as a cathode were used in this work. The two electrodes were 1 cm apart. Tetrabutylammonium bromide (C16H36BrN) and Tetrapropylammonium bromide (C12H28NBr) (0.01 M) in acetonitrile/tetrahaydrofuran (4:1) served as supporting electrolyte. Upon applying current density of (8, 10 and 12 mA/cm^2) obtained > 95% of tin oxide clusters stabilized by TPAB and TBAB. On application of electrical current, the anode slowly dissolves leading to formation and subsequently get passivated by active TPAB and TBAB species. The cluster size was found to decrease with an increase in current density.

This electrochemical reduction preparation of SnO_2 nanoparticles is shown in Fig. 1.

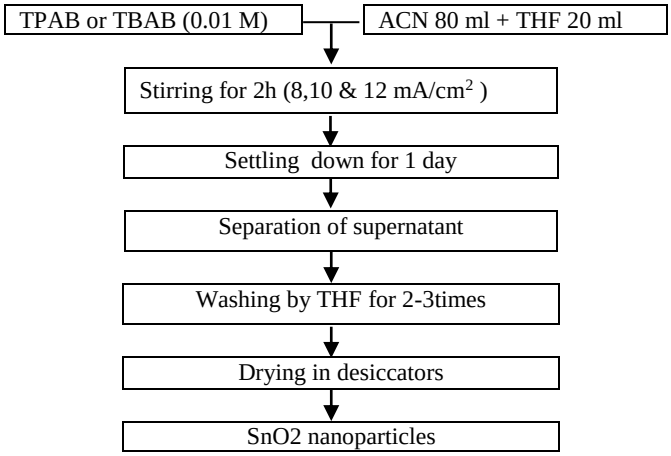

Fig. 1. Electrochemical reduction preparation of SnO_2 nanoparticles.

III. Results and Discussion

A. SEM Analysis of Tin Oxide Nanoparticles

The surface morphology of SnO_2 nanoparticles is studied by scanning electron microscope. Fig. 2 shows the SEM image SnO_2 nanoparticles with magnification of 600. The instrumental parameters, accelerating voltage, spot size and magnification are used to obtain SEM image. It shows the microstructure of the electrochemical reduction, which runs the tin oxide nanoparticles that reveals the presence agglomerations.

The appearance of some particles has an irregular shape and their distributions are not uniform, and it is due to the partial solubility of surfactant in the solvent under the given experimental conditions at room temperature.

B. EDS Analysis of Tin Oxide Nanoparticles

The chemical compositions of synthesized tin oxide nanoparticles have been studied by EDS. Table I shows the ratio of oxygen and tin, which contains weight 55.03% and atomic 90.08 % of oxygen and weight 44.97% and atomic 9.92% of tin. Thus the total ratio of both elements equals to 100. Fig. 3, EDS, indicates the presence of both elements.

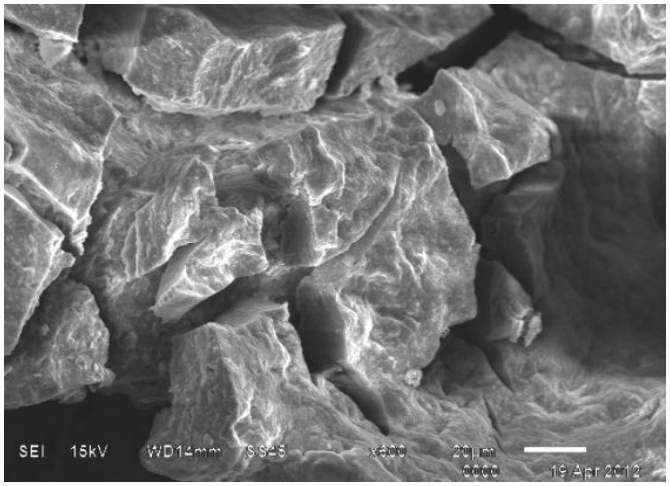

Fig. 2. SEM image of a prepared tin oxide nanoparticles capped with 0.01M TPAB (current density 10 mA/cm^2).

TABLE I
Chemical Composition of Tin Oxide Nanoparticles

Element	Weight%	Atomic%
O	55.03	90.08
Sn	44.97	09.92
Total	100.0	

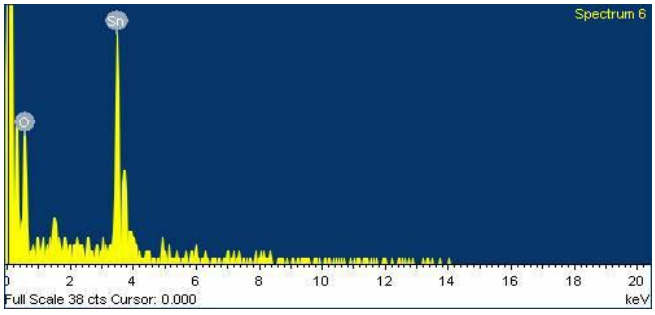

Fig. 3. Energy Dispersive Spectrum indicating the chemical composition of freshly prepared SnO_2 nanoparticles capped with 0.01M TPAB (current density 10 mA/cm^2).

C. FTIR Analysis of Tin Oxide Nanoparticles

Fig. 4 Shows Fourier transformed spectrum of SnO_2 nanoparticles at room temperature. The spectrum has been recorded in the range of 4000-800 cm^{-1}. The FTIR spectrum shows the characteristic peaks at 1378, 968, 565 and 533 cm^{-1}. The bands at 1378 cm^{-1} and 968 cm^{-1} have been assigned to lattice vibrations due to decreasing the intensity which leads to overtones and combinations.

The bands around 565 and 533 cm^{-1} have been attributed to Sn-O stretching modes of Sn-O-Sn, respectively, revealing of the presence of SnO_2.

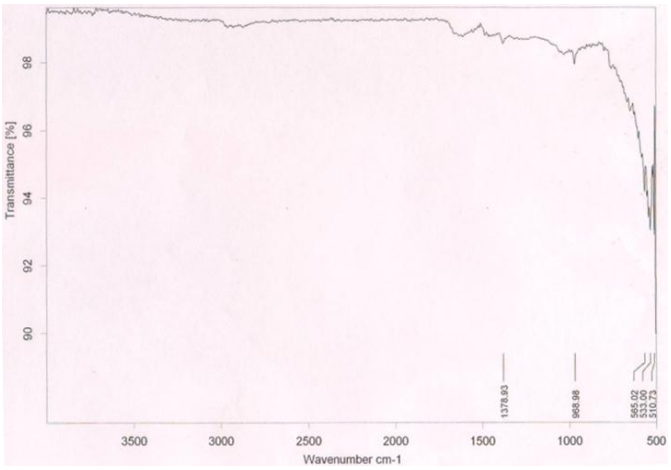

Fig. 4. FTIR of SnO_2 nanoparticles capped with 0.01 M TPAB (current density 10 mA/cm^2).

D. UV-Visible Analysis of Tin Oxide Nanoparticles

The optical absorptions of tin oxide spectrum at (8, 10 and 12 mA/cm^2) are sketched in the Figs. 5, 6, 7, 8, 9 and 10 and their absorbance are given in Tables II, III, IV, V, VI, and VII, respectively. It can be seen that the strongest absorption peak of the prepared samples at different mA of all samples appears at around 300 nm, 298 nm and 292 nm, which is fairly blue shifted from the absorption edge of SnO_2 nanoparticles. The UV-visible light emission peak at 342 nm of SnO_2 are related to the defect levels within the band gap such as O vacancies and Sn interstitial sites form during the particle growth. The emission peak at 362 nm generally ascribed to the band-to-acceptor transition and related to impurity or defect concentration. The peak at 402 nm can be attributed to structural defect, such as nanocrystals and defects in SnO_2 nanoparticles and the emission peak at 502 nm is likely originate from oxygen vacancies where its intensity increase with increase concentration of oxygen vacancies. Also, the effect of current on tin oxide nanoparticles, which taken at different current densities, with increasing of current density leads to increase of absorption intensity and decrease of particle size.

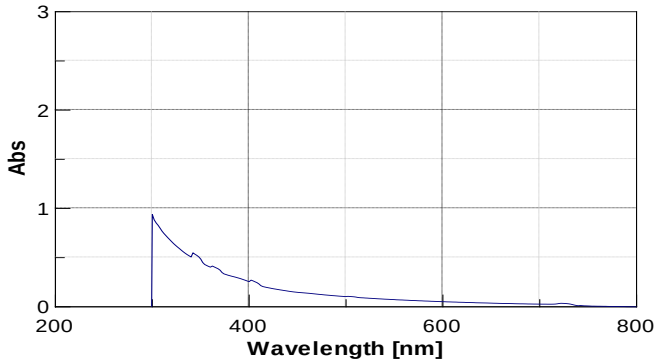

Fig. 5. UV-visible spectra of SnO_2 Nanopaticles capped with 0.01 M TPAB (SNTPAB) at 8 (mA/cm^2).

TABLE II
ABSORBANCE OF SNTPAB AT 8 (mA/cm^2)

No.	nm	Abs
1	402	0.272
2	362	0.415
3	342	0.550
4	300	0.939

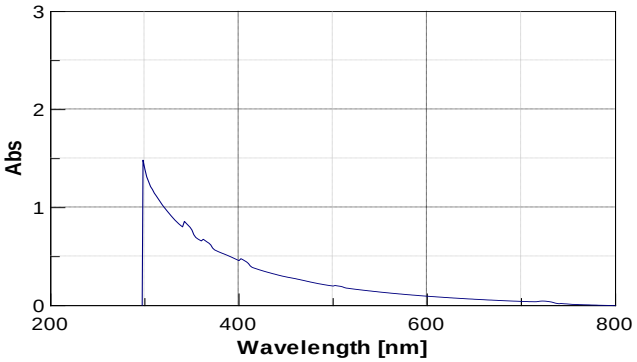

Fig. 6. UV-visible spectra of SnO_2 Nanopaticles capped with 0.01 M TPAB (SNTPAB) at 10 (mA/cm^2).

TABLE III
ABSORBANCE OF SNTPAB AT 10 (mA/cm^2)

No.	nm	Abs
1	402	0.480
2	362	0.678
3	342	0.861
4	298	1.485

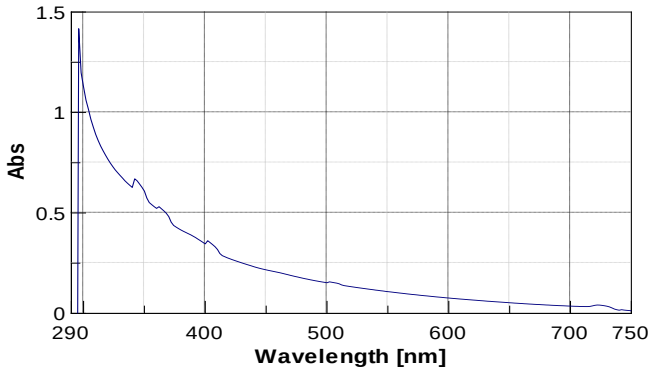

Fig. 7. UV-visible spectra of SnO_2 Nanopaticles capped with 0.01 M TPAB (SNTPAB) at 12 (mA/cm^2).

TABLE IV
ABSORBANCE OF SNTPAB AT 12 (mA/cm^2)

No.	nm	Abs
1	402	0.362
2	362	0.487
3	342	0.672
4	292	1.417

 http://dx.doi.org/10.14500/aro.10028

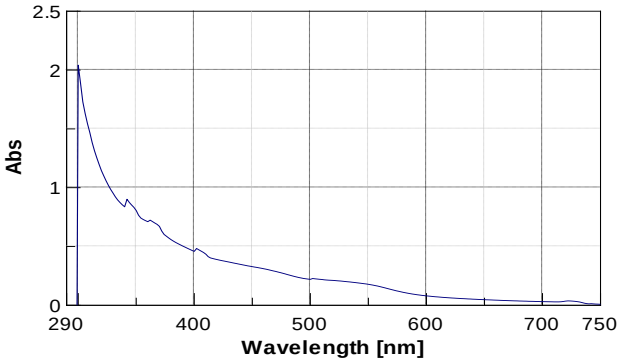

Fig. 8. UV-visible spectra of SnO_2 Nanopaticles capped with 0.01 M TBAB (SNTBAB) at 8 (mA/cm^2).

TABLE V
ABSORBANCE OF SNTBAB AT 8 (mA/cm^2)

No.	nm	Abs
1	402	0.483
2	362	0.724
3	342	0.902
4	300	2.042

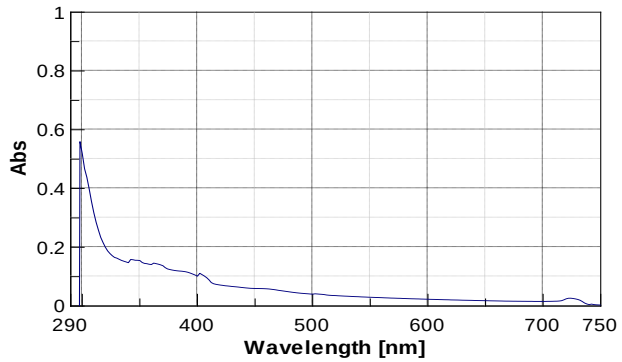

Fig. 9. UV-visible spectra of SnO_2 Nanopaticles capped with 0.01 M TBAB (SNTBAB) at 10 (mA/cm^2).

TABLE VI
ABSORBANCE OF SNTBAB AT 10 (mA/cm^2)

No.	nm	Abs
1	502	0.042
2	402	0.112
3	362	0.146
4	342	0.159
5	298	0.560

E. Calculation of SnO2 Nanoparticle size from UV-Visible Spectra

An absorption spectrum as shown in Figs. 5, 6, 7, 8, 9 and 10 can be obtained. The absorption peak appears at around 300 nm, 298 nm and 292 nm for different mA by using TPAB and TBAB salts. Using the excitation peak position (300, 298 and 292 nm) can be determined the band gap (E=hc/λ) of them, which are calculated (4.13, 4.16 and 4.24 ev). This can be calculated as the size of the nanoparticle, as given the following relation.

$$R = \sqrt{\frac{2\pi^2 h^2 E_{bulk}}{m*(E^2{}_{nano} - \ E^2{}_{bulk})}} \quad (1)$$

Where R is the radius of the quantum size particles i.e. nanoparticles, tin dioxide has bulk band gap energy *Eg* of 3.6 eV and the effective reduced mass μ may be replaced by the electron effective mass ($me^* = 0.277m0$). These values have been used for calculating the average size of excitation peaks at different current density, which are determined as (2.19, 2.13 and 1.98 nm). When the particle size decreases, the band gap increases. It can be concluded that the synthesis particles are nanoparticles, as shown in table VIII.

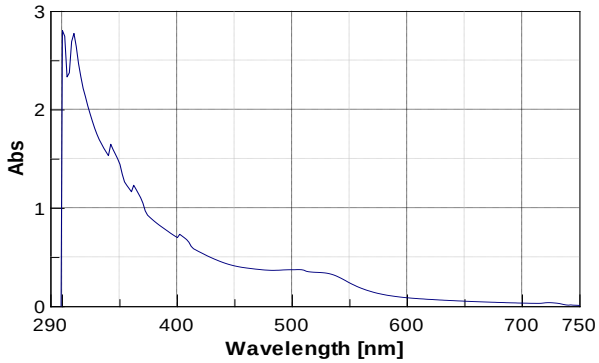

Fig. 10. UV-visible spectra of SnO_2 Nanopaticles capped with 0.01 M TBAB (SNTBAB) at 12 (mA/cm^2).

TABLE VII
ABSORBANCE OF SNTBAB AT 12 (mA/cm^2)

No.	nm	Abs
1	506	0.378
2	402	0.736
3	362	1.235
4	342	1.652
5	310	2.778
6	292	2.807

TABLE VIII
VARIATION OF AVERAGE PARTICLE SIZE OF SNO2 NANOPARTICLES AND BAND GAP WITH CURRENT DENSITY AT DIFFERENT (mA/cm^2)

Current density (mA/cm^2)	λ_{max} (nm)	Band gap (ev)	Particle size (nm)
8	300	4.13	2.19
10	298	4.16	2.13
12	292	4.24	1.98

IV. CONCLUSION

Nanoparticles of SnO_2 have been successfully synthesized through electrochemical reduction method successfully for

synthesis of SnO_2 nanoparticles. The TPAB and TBAB salts are used as surfactant or capping agent have played significant role on controlling the particle size and serves as stabilizers for the metal clusters. Agglomeration and formation of undesired metal are prevented by presence ammonium stabilizers, also acetonitrile/tetrahydrofuran used as supporting electrolyte. Cluster size was found to decrease with an increase in current density. UV-visible spectroscopy shows that by increasing current density the absorption intensity increases, particle size decreases and band gap energy increases. The FTIR transmission of SnO_2, n-type semiconductor, is sharply decreasing by electron absorption and the quality of vibrational information concerning the surface species, which depends strongly on the nature of the parameters. SEM confirms that the particles are in nano size and appearances of some particles are in irregular and block shapes. EDS confirms the total ratio of tin oxide nanoparticles and their chemical composition.

ACKNOWLEDGMENT

The author expresses immense thanks to Dr. A.S. Rajbhoj, professor of department of chemistry and physical chemistry staff and Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, Maharashtra-India, for their valuable suggestions and assistances.

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 http://dx.doi.org/10.14500/aro.10031

Gender Prediction of Journalists from Writing Style

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***Abstract*—Web-based Kurdish media have seen a tangible growth in the last few years. There are many factors that have contributed into this rapid growth. These include an easy access to the internet connection, the low price of electronic gadgets and pervasive usage of social networking. The swift development of the Kurdish web-based media imposes new challenges that need to be addressed. For example, a newspaper article published online possesses properties such as author name, gender, age, and nationality among others. Determining one or more of these properties, when ambiguity arises, using computers is an important open research area. In this study the journalist's gender in web-based Kurdish media determined using computational linguistic and text mining techniques. 75 web-based Kurdish articles used to train artificial model designed to determine the gender of journalists in web-based Kurdish media. Articles were downloaded from four different well known web-based Kurdish newspapers. 61 features were extracted from each article; these features are distinct in discriminating between genders. The Multi-Layer Perceptron (MLP) artificial neural network is used as a classification technique and the accuracy received were 76%.**

***Index Terms*—Gender identification, Kurdish media, Neural networks, Text mining.**

I. Introduction

Telecommunication and Internet sectors have witnessed a rapid development in Iraq after year 2003. According to Internet World Stats (www.internetworldstats.com), the number of Internet users is estimated to be 2.5 million users in 2012 while this number was 1.3 million in December 2011. This growth in the telecommunication and Internet sectors is mainly due to the vast growth of these sectors in Iraqi Kurdistan region. According to the Kurdistan Region's Ministry of Communication and Transportation web site (www.moc-krg.com), there are two major Internet companies along with 21 other smaller companies operate in Kurdistan region providing Internet services.

Alongside the rapid growth of the Internet infrastructure, a large number of Kurdish websites and web-based newspapers have appeared, as well. Some of these newspapers have become very well-known and they have a large user base. Furthermore, the growth in Internet and telecommunication sectors has led to easy access, low in pricing and enabled pervasive usage of social networking. These changes, in turn, made it possible for anyone to publish and share opinion. Nowadays, not only main stream media can publish articles but any person can do so using Facebook pages, blogs or a personal web page. With the easy access, inexpensive electronic gadgets, and pervasive usage of social networking comes the problem of anonymous publishing and identity faking problem. Currently, fake personalities on social networks like Facebook and Tweeter are wide spread phenomenon.

Gender identification research falls under a wider research area known by *authorship identification.* Studies in the latter field include the attribution of disputed Shakespearian poetries done by (Efron and Thisted, 1976), and (Merriam, 1996). On the other hand, early works on gender identification, which is about an examination of a specific part of authorship identification, has been conducted by (Lakoff, 1973), and (Labov, 1990). These works have concluded that there are differences in the male and female writing style.

The objective of this study is to identify authors' gender from their online writing style. More precisely, the main question of this research work is that "Would be possible to distinguish male writers from female writers based on their online writing?" This question has already been answered for languages such as English and Arabic. This paper applied a technique not used before to a language that never examined for this purpose. To the best of our knowledge, this effort is the first of his kind. Thus, this paper has opened a new research direction in this field for Kurdish language.

ARO, The Scientific Journal of Koya University
Volume I, No 1(2013), Article ID: ARO.10031, 7 pages
DOI: 10.14500/aro.10031
Received 26 September 2013; Accepted 12 November 2013
Regular research paper: Published 20 November 2013
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The rest of this study is organized as follow: in Section II the most relevant work to this study are reviewed. In Section III, study challenges and assumptions are discussed. In Section IV, the solutions and experimental results are presented, and finally in Section V we conclude the paper.

II. Related Works

In this section the most relevant works to this study are reviewed. The focus of the review has been put on the works related to the computation linguistic, machine learning and statistical-based classifier. The review is conducted in a systematic way. That is, five prominent aspects of the reviewed works have been considered. The aspects are: 1. aim of the work, 2. scope of the work, 3. features extracted, 4. classifiers type, and 5. success ratio.

A study conducted by (Cheng, et al., 2009) for identifying the gender of email composers. The scope of the work was short length, multi-genre, content-free emails. The authors extracted 545 features distributed over five classes. The Features were character, word, syntactic, paragraph and function based. The authors used decision tree and support vector machine classifiers to identify email owners, and they obtained an average accuracy of 82.2%. The same previous research team conducted another set of experiments (Cheng, Chandramouli and Subbalakshmi, 2011). This time they used Reuter's newsgroup dataset, a collection of reports and articles form journalists in English language. The authors augmented the Reuter's dataset with the informal email texts in order to have a mixed dataset of formal and informal English writing. During the study, they extracted 545 features of five types. They also used three types of classifiers, decision tree, support vector, and machine and Bayesian-based logistic regression classifier. They obtained this time an accuracy rate of 85%. The study concluded that among the five feature types studied, the word, structure and function features were more effective than the other two features, paragraph and syntactic.

Texts collected from the Tweeter and other social networks and blogs comprise a good experimental dataset. This is because there is no censorship on these social networking and people who use this service are entirely free to express what they like/dislike. However, there is a problem associated with using social networking data. That is, labeling and parsing account owners need to be performed manually before they can be used for training set.

A research has been conducted by (Burger, et al., 2011) to discriminate gender of account owners in the social network Tweeter. Features extracted in Burger's study were n-gram for both word-level and character-level. The extraction process done for four types of text, the profile name, full name, description and tweets. Each extracted n-gram feature is a simple indicator of zero and one, one for existing and zero is the future doesn't exist. The authors used support vector machine, Naive Bayes and Balanced Winnow2 classifiers, and they obtained an accuracy ratio 67% for Naïve Bayes, 71% for SVM and 74% for Winnow2. A noticeable difference between this study and other previous studies is this one worked on a collection of languages instead of only English language used by others.

Another group of researchers (Deitrick, et al., 2012) have conducted a study to identify the gender of account owners in Tweeter. What is unique about this study is that the authors accounted for two important aspects of the social networking. That is, they considered steam processing, and feature reduction. The first aspect is important because text/data changes and get updated with the time and the second aspect is conducted as a preprocessing step for performance improvement.

They extracted about 9000 features of type n-gram (1-gram and 2-gram) where n-gram refers to an existence/inexistence of a character or two in a passage. In Addition to using 1-gram and 2-gram features, the authors also used the feature selection process, also called also called dimensionality reduction, which is about selecting the most affective features among all features to improve efficiency in large data sets. In the study a special kind of neural networks classifier called Modified Balanced Winnow classifier is used for processing streams. The study obtained 82.48% accuracy. This rate increased to 98.5% after feature reduction process.

A research done by (Herdağdelen, 2013) was concentrated on a potential combining of an n-gram text corpus from twitter messages with demographics metadata. He used these messages coupled with metadata about their authors to understand a wide variety of phenomena ranging from political polarization to geographic and demographic lexical variation. Gender was among these metadata used with n-gram for this purpose.

Another team (Nguyen, et al., 2011) has studied text for other human properties but not the gender. They investigated manifest properties of textual messages, including latent topics, psycholinguistic features, and author mood, of a large corpus of blog posts, to analyze the impact of age, emotion, and social connectivity. These properties are found to be significantly different across the examined cohorts. They build binary classifiers for old versus young bloggers, social versus solo bloggers, and happy versus sad posts with high performance.

III. Challenges and Assumption

This section briefly describes gender identification challenges for online newspapers and our assumptions as well as the difficulty we faced while processing text writing in Kurdish language.

A. Challenges in Gender Identification

Identifying true genders of authors from writing style faces two inherited challenges: the first one is Editing, and the second one is Unified writing style.

Site owners, similar to paper based newspapers, may edit text or apply templates to unify writing style on their sites, thus, intervening in the authors' writing style. For the purpose of this study, we assume that site owners publish articles without editing. This assumption is valid for Kurdish online

 http://dx.doi.org/10.14500/aro.10031

newspapers, because most of these newspapers publish their service free of charge, and they do not employ professional editors. To address the second problem, we choose long and medium size articles for our study. It has been proven that despite applying templates in order to unify writing styles the writing style in long and medium size articles remain unchanged.

Using long passages have helped us to avoid, yet another problem which we named *disguise problem*, female authors intentionally following male styles of writing. In Kurdistan, journalism is a male dominate professional where majority of the famous journalists, reporters, analyzers are males. Hence, sometimes Kurdish female authors intentionally follow male styles writing, thus, making author gender identification to be even a harder problem. This situation is minimized using long passages in our study. This is because it is harder for female authors to continue act like males in long writings.

B. Kurdish Text Processing Challenge

Kurdish language has two writing script, Latin and Arabic based writing scripts. In this study the focus is put on the Arabic based writing script. Using Arabic based script for our study is not trouble free. It requires special IDE configuration and programming language knowledge in order to process text. This problem is solved by using techniques and programs used by (Yunis, 2012).

IV. The Classifier Model and Experimental Results

Extracting effective features from text is the most important step for discriminating between genders in the authors writing style. This section explains preliminary steps and experimental setups, then lists the features extracted for this study followed by a description for the classifier model used in this study and finally results are presented. Generally the system can be illustrated in the process diagram shown in the Fig. 1.

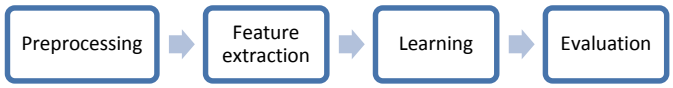

Fig. 1 Process diagram of the system

A. Preliminary Steps and Experimental Results

For the purpose of this study four online Kurdish newspapers were selected. These newspapers are Hawlati, Khabat, Hawler, and Gulan. The basis for selecting these newspapers was their popularity; the paper-based versions of these newspapers are distributed across Kurdish region. The total number of articles selected for the experiment was 75. Each article is labeled by male or female (according to the name of the journalist). Table I presents the number of articles taken from each newspaper as well as number of male/ female authors in each newspaper.

In order to keep the originality and avoid losing writing style, no editing or cleaning processes were executed on the collected data. After tokenizing the collected data according to spaces, the number of words in each article is counted. The result of this step is depicted in Table II.

TABLE I
Number of Articles According to Newspapers and Gender of Journalists

Newspaper	Number of articles	Number of males	Number of females
Hawlati	6	5	1
Khabat	29	20	9
Hawler	16	13	3
Gulan	24	17	7

TABLE II
Average Number of Words According to Newspapers and Gender of Journalists

Newspaper	Average number of words	Average number of words (male)	Average number of words (female)
Hawlati	802	828	696
Khabat	896	841	1018
Hawler	374	417	184
Gulan	859	963	606

B. Feature Extraction

Each passage has its own embedded features, and existing gender identification solutions are based on feature extraction. Hence, this step is considered as the most effective step out study. For this study, 61 unique features were extracted for each article. The extracted features were clustered into five different types. These feature types are character, word, syntactic, paragraph and 1-gram based features. All extracted features are showed in the Table III.

A Java code was used to extract features from articles because Java has the ability to process Kurdish texts easily (Yunis, 2012). Fig. 2 is the algorithm used for extracting number of letters in an article as one of the character-based features. Fig. 3 is the algorithm used for extracting number of words in an article as one of the word-based features. Fig. 4 is the algorithm used for extracting number of question marks in an article as one of the syntactic-based features. Fig. 5 is the algorithm used for extracting number of sentences in an article as one of the paragraph-based features. Fig. 6 is the algorithm used for determining the frequency of letter " د " in an article as one of the 1-gram features.

The extracted features are collected in a Microsoft- Excel sheet to be processed by a neural model. Fig. 7 shows a sample of the features extracted from articles to be used as a training set later.

For classifying purposes and training a supervised model target classes are necessary. The target classes are collected in a Microsoft-Excel file sheet, this sheet is processed later by the model. Fig. 8 shows a sample of the target classes, as mentioned before the classes are labeled manually.

The same spread sheets (features sheet and targets sheet) are prepared for the evaluation set, in other words, two other Microsoft-Excel sheets are prepared for determining the accuracy rates. This step is better explained in section IV-G.

TABLE III
EXTRACTED FEATURES

Feature	Number of extracted features	Features
Character-based	8	Total number of special characters Total number of letters Total number of special characters and letters Total number of special characters, letters and spaces Total number of white space Ratio of letters over special characters Ratio of letters over characters Ratio of letters over special characters and letters
Word-based	6	Total number of words in the article Ratio of word length Words longer than six characters Average words longer than six characters Total number of short words Average number of short words
Syntactic-based	12	Number of commas Ratio of commas to characters Number of periods Ratio of periods to characters Number of colons Ratio of colons to characters Number of semicolons Ratio of semicolons to characters Number of question marks Ratio of question marks to characters Number of exclamation marks Ratio of exclamation marks to characters
Paragraph-based	2	Number of paragraphs. Number of sentences
1-gram	33	Frequency of letter "ا" Frequency of letter "ب" , and all other Kurdish letters.

C. The Software Used for Training

The software used in this paper for learning the model is MATLAB 7.6. It provides a very easy to use and friendly environment which makes our job easier. An important note here is that MATLAB initializes all weights and bias values required to start learning process. Users are only asked to specify the structure of the model like number of hidden layers and number of nodes inside each layer, also type of the transfer functions for each layer should be specified. The extracted features and the target classes, which are already saved in the Excel sheets, are fed to the model as parameters.

```
algorithm: Total number of letters in an article
input: string article
output: integer i

for all line ∈ article do
    for all word ∈ line do
        if word is not punctuation then
            for all letter ∈ word do
                if letter is not punctuation then
                    increment i
return i
```

Fig. 2. The algorithm for extracting number of letters in an article.

```
algorithm: Total number of words in an article
input: string article
output: integer i

for all line ∈ article do
    for all word ∈ line do
        if word is not punctuation then
            increment i
return i
```

Fig. 3. The algorithm for extracting number of words in an article.

```
algorithm: Total number of question marks in an article
input: string article
output: integer i

for all line ∈ article do
    for all word ∈ line do
        for all letter ∈ word do
            if letter == " ? " then
                increment i
return i
```

Fig. 4. The algorithm for extracting number of question marks in an article.

```
algorithm: Total number of sentences in an article
input: string article
output: integer i

for all line ∈ article do
    for all word ∈ line do
        for all letter ∈ word do
            if letter == " . " then
                increment i
return i
```

Fig. 5. The algorithm for extracting number of sentences in an article.

 http://dx.doi.org/10.14500/aro.10031

```
algorithm: Total number of letter " د " in an article
input: string article
output: integer i

for all line ∈ article do
        for all letter ∈ line do
                if letter == " د " then
                        increment i
return i
```

Fig. 6. The algorithm for determining the frequency of letter " د ".

	A	B	C	D	E	F	G	H	I	J	K
1	11	2884	2895	3315	420	262	0.869984917	0.996200345	416	6.932692308	218
2	8	2220	2228	2632	404	277	0.843465046	0.996409336	402	5.52238806	139
3	12	4472	4484	5227	743	372	0.855557681	0.997323818	743	6.01884253	314
4	19	4664	4683	5464	781	245	0.853587116	0.995942772	782	5.964194373	310
5	3	3401	3404	4095	691	1133	0.830525031	0.999118684	692	4.914739884	205
6	9	3527	3536	4151	615	391	0.849674777	0.997454751	615	5.73495935	246
7	6	9318	9324	10857	1533	1553	0.858248135	0.999356499	1534	6.074315515	625
8	17	4897	4914	5762	848	288	0.849878514	0.996540497	849	5.767962309	318
9	35	6816	6851	7818	967	194	0.871834229	0.994891257	967	7.04860393	505
10	14	4910	4924	5594	670	350	0.877726135	0.997156783	669	7.339312407	364
11	26	2562	2588	3014	426	98	0.850033179	0.989953632	427	6	163
12	14	4311	4325	5162	837	307	0.835141418	0.996763006	838	5.144391408	226
13	19	9106	9125	10836	1711	479	0.840346992	0.997917808	1712	5.318925234	491
14	13	7363	7376	8771	1395	566	0.839470984	0.998237527	1395	5.278136201	426
15	35	5655	5690	6684	994	161	0.846050269	0.993848858	995	5.683417085	348
16	24	4539	4563	5350	787	189	0.848411215	0.994740302	778	5.834190231	315
17	32	11962	11994	14013	2019	373	0.85363591	0.997331999	2019	5.924715206	811

Fig. 7. The features collected in an MS-Excel sheet.

	A	B	C	D
1	1			
2	1			
3	1			
4	1			
5	1			
6	1			
7	-1			
8	-1			
9	-1			
10	-1			
11	-1			
12	-1			
13	-1			
14	-1			
15	-1			
16	-1			

Fig. 8. The target classes collected in an MS-Excel sheet.

D. Data Normalization

Data normalization is not necessary in MLP because input variables are combined linearly, then it is rarely strictly necessary to standardize the inputs. For making sure the input set is normalized and given to the model, there was no sensible difference between results. The reason is that any rescaling of an input vector can be effectively undone by changing the corresponding weights and biases, getting the outputs as you had before. There are a variety of practical reasons why standardizing the inputs can make training faster and reduce the chances of getting stuck in local optima but because that the training algorithm is Levenberg-Marquardt, and it's known that LM is very fast and it can overcome all local minimums, for these reasons the data were not normalized but fed directly to the model.

E. The Classifier

The technique used in this paper is a Multi-layer Perceptron (MLP) Neural Network Binary Classifier model. This is because MLP model is a very efficient classifier for binary classification (in our case male vs. female). This MLP model consists of three layers: an input, a hidden layer and an output layer. The number of nodes in the input is 61, each node is specialized for inputting an extracted feature. The number of nodes in the hidden layer is 30, and there is only one node in the output layer. The structure can be summarized as 61-30-1. The model structure is illustrated in the Fig. 9.

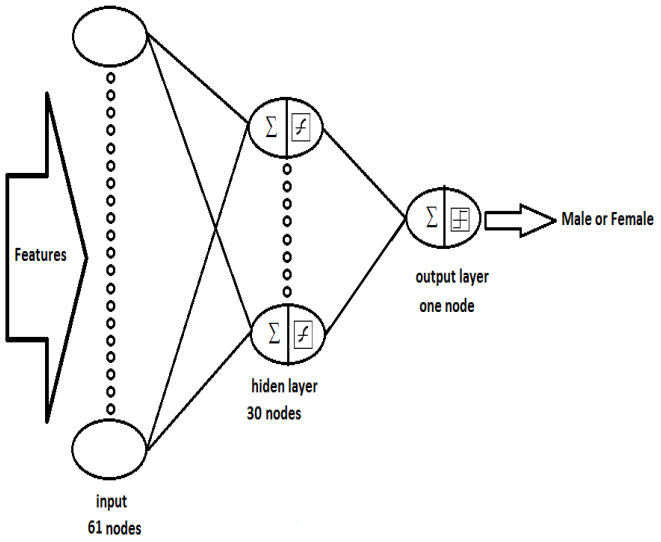

Fig. 9. Multi-layer perceptron neural network model.

The information in MLP moves forward (feed-forward) which is a simplest type of neural networks, in this type of network the information moves from input nodes to the hidden layer nodes and finally to the output layer nodes, information is not going back in a cyclic path to the input nodes or hidden layer nodes. A single node in the neural network model is called perceptron, a model consist of a number of these perceptrons arranged in layers that is why sometimes called multi-layer perceptron or MLP. A multi-layer perceptron or feed-forward network may consist of a single-layer or more than one layer. In such networks number of hidden layers is optional. Notice that the word "layer" hasn't been appended to the word "input". This is because input is not a real layer (no summation, no bias, and no transfer function). For explaining how the network used in this paper works, it's necessary to understand how a simple perceptron or a neuron works. Let us take a neuron from hidden layer as an example, Fig. 10.

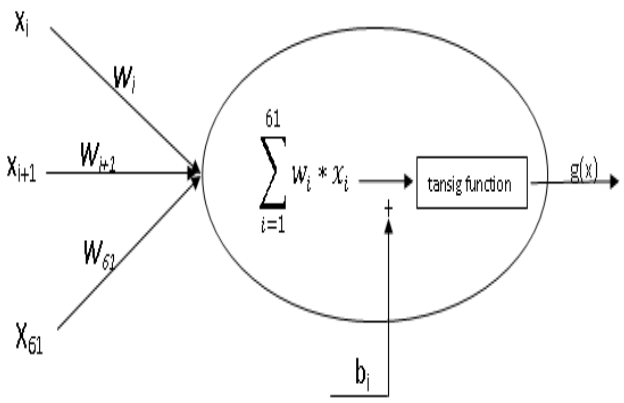

Fig. 10. A simple neuron from hidden layer

$$\text{tansig}(x) = \frac{2}{(1+e^{-2x})-1} \qquad \text{hardlimits}(x) = \begin{cases} -1, & x < 0 \\ 1, & x \geq 0 \end{cases}$$

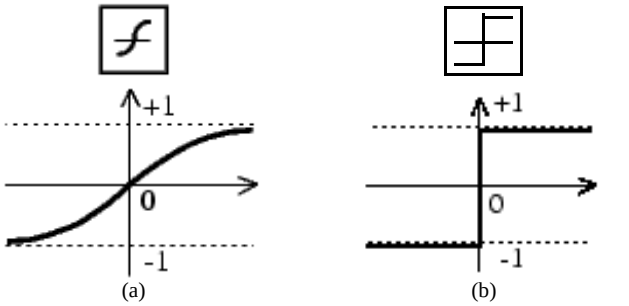

Fig. 11. (a) Hyperbolic tangent function. (b) Symmetric hard limit function

The information that fed to the neuron from 61 input neurons are multiplied by their connection weights then summed together, also summed with the bias value. The resultant value is fed to the transfer function in this case a tansig, Fig. 11-a, the result of this function is the output of the neuron or perceptron. The resultant value will be between 1 and -1, because of the range of tansig function which lays in this period. (1) gives the feed-forward mathematical process in the hidden layer:

$$d(j) = tansig\left\{ \quad \left[\sum_{i=1}^{61} \mathrm{X(i)} * \mathrm{W(i)}\right] + [b(\mathrm{j})] \quad \right\} \qquad (1)$$

where: d(j) is the output of a neuron in the hidden layer, X(i) is the input value from input neuron i, W(i) is the weight of connection between input neuron i and the neuron j, and b(j) is the bias value of the neuron j.

The same process is repeated in all 30 neurons of the hidden layer, then this 30 information are fed to the output layer and the same process is repeated. Number of nodes in the output layer is only a one node. The transfer function here is different, symmetric hard limit function was used as in Fig. 11-b, where the result takes only two values -1 or 1. Class 1 is used for female whereas class -1 is for male. The feed-forward mathematical process in the output layer is declared in (2);

$$D = symmetrichardlimits\left\{\left[\sum_{\mathrm{j}=1}^{30} X(\mathrm{j}) * W(\mathrm{j})\right] + [b]\right\} \qquad (2)$$

where: D is the output of a neuron in the output layer, X(j) is the output of the neuron j from hidden layer, W(j) is the weight of connection between hidden neuron j and the output neuron, and b is the bias value of the output neuron.

F. Learning Process

Back-propagation is a common method used for supervised learning. In this method an artificial network learns from comparing an output with desired outputs, then propagating the error occur in a backward direction by justifying the weights of the connections between nodes. This backward propagation needs the transfer functions used in the nodes to be differentiable to ensure smooth back-distribution of errors on the weights.

In the supervised learning, desired or target results is compared with the obtained results and the squared error is calculated according to (3):

$$Er = (T - D)^2 \qquad (3)$$

Where: Er is a squared error, T is the target value, and D is the desired value

Optimization methods are used to minimize this error value Er. There are lots of methods that can be used for this issue. In this paper a Levenberg-Marquardt optimization is used for optimizing errors. The LM is one of the best and most efficient methods for optimizing backpropaation of errors which designed to approach second-order training speed (Esugasini, et al., 2005). Not like other backpropagation algorithms, LM is very fast and doesn't have a problem of local minimums.

G. Results

During the study, 65 of the selected articles (87%) were used for training the neural network model, and the other 10 articles (13%) were used for evaluation process. The model tested 10 times over different sets, randomly separated to training and evaluation sets (i.e each time 65 for training and 10 for evaluation). The average of the 10 trials was taken in consideration as accuracy of the model. Table IV summarizes the experimental results obtained at each test as well as the average accuracy rate for the study, 76%.

TABLE IV
THE ACCURACY RATIO OF 10 FOLDS

Fold	1	2	3	4	5	6	7	8	9	10
Accuracy %	60	80	90	70	80	80	80	70	70	80
Average %	76									

The result in Table IV indicates that if our model is used for determining or discriminating the gender of a journalist or a column writer in a web-based Kurdish media the model can obtain result with the 76% accuracy rate.

V. Conclusion

Discriminating between genders through writing styles is a difficult problem in Kurdish language. This is because the language itself (Sorani dialect) doesn't discriminate between genders. This work is a first step towards a comprehensive study on the gender identification using writing styles in Kurdish language. The study used online newspapers as a data source, and feed-forward MLP as the classifier. During the study, 61 unique features of five types were extracted. These features types were character, word, syntactic, paragraph and 1-gram based features. The accuracy rate of the study was 76% success rate. Tested samples contained persons have good knowledge in punctuation marks the system will identified them too. Also it has been concluded that the accuracy rate various from one language to another, and one of the reasons for the difference among languages is due to the language flexibility to express gender differences and emotions.

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Structure, Dielectric Properties and AC Behavior of Commercial Polytetrafluroethylene (PTFE) Polymer

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***Abstract*—In this work the relative permittivity (ε'), dielectric loss (ε'') and AC-conductivity (σ_{AC}) for commercial polytetrafluroethylene (PTFE) have been measured at different temperatures (20-110°C) and over the frequency range from 10 KHz to 1 MHz. The infrared (IR) spectra of PTFE also been investigated to detect the presence of polar groups and carbon double bonds. The relative permittivity had observed to decrease with increasing frequency and temperature. Some loss peaks were observed in the dielectric loss spectra, which referred to the relaxation, arises from the orientation of unsaturated double ($C = C$) bond and polar additives. The diameter of the semicircles in Cole-Cole (ε'' versus ε') plots are not coincides with x-axis at different temperature which reveals that the relaxation processes are non-Debye type. The AC-conductivity increases with increasing of frequency and almost independent on the temperature.**

***Index Terms*—AC conductivity, Dielectric loss, IR spectra, Non-polar PTFE, Relative permittivity.**

I. Introduction

Polymers are large molecules formed by linking together of many small molecular units know as monomers. These are covalently bonded together in any conceivable pattern. Molecular structure and the arrangement of polymer chain in a solid are important factor in determination their properties. Polymers are ideal material for industrial application because they have desirable properties such as durability, processability, transparency, electrical and thermal resistance. Indeed, we live in the world of polymers. That is why scientist and technologists have termed this area as the polymeric age (Singh, 2006). Dielectric measurements such as relative permittivity and dielectric loss reveal significant information about the chemical and physical state of polymers (Vijayalakshmi, Ashokan and Shridhar, 2000). For electrical insulation application, a large band gap, a low relative permittivity and a low dielectric loss over a wide frequency range are desirable (Dilip, 1994). Non-polar polymers like polyethylene (PE), polypropylene (PP) and polytetrafluoroethylene (PTFE) are very important electrical insulating and dielectric materials. They are used in the increasingly high AC electric field strength region approaching to the limit of electrical breakdown strength of the material (Fujii, et al., 2006). PTFE polymer is an engineering thermoplastic which shows a remarkable chemical resistance, electrical insulating properties as well as a low friction coefficient. These mentioned properties enables PTFE polymer as a raw material for non-stick coatings, electrical components, bearing and tapes (Stuart, 2002). The PTFE is insoluble in all common solvents and is highly resistant to chemical attack. Its combination of electrical properties is outstanding with high dielectric strength and extremely low dielectric loss. PTFE is very stable over the widest temperature range of any known insulating polymer (Duncan and Mark, 2002). In this paper we report the dielectric properties and AC conductivity of commercial PTFE which is known as Teflon (Trade name), at different temperatures and different frequencies. IR spectra have also been reported.

ARO, The Scientific Journal of Koya University
Volume 2013, Article ID, 5 pages
DOI: 10.14500/aro.10033
Received 08 October 2013; Accepted 03 November 2013
Regular research paper: Published 03 December 2013
Corresponding author's e-mail: shujaadeen78@yahoo.com

II. Experimental Method

A. Sample Preparation

The PTFE used in the present work is obtained from the commercial source (Nokan Plastic Factory). The PTFE sample is impure and, produced by extrusion molding. For the dielectric measurements, the PTFE sample was cut into slab of 6 cm in diameter and 1.75 mm in thickness by using precision micrometer. The surface of the PTFE sample was polished in order to get a smooth surface for good electrical contact between the sample and the electrodes. The dielectric loss cell was locally designed. The heating coil was made from a resistive wire in the form of circular coil arranged symmetrically in the chamber. The resistance coil is connected

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to an A.C source variac transformer. The current through this heater was adjusted to optimal. To eliminate temperature gradient the system was heated for several hours to achieve thermal equilibrium. The sample holders which were used to measure the electric parameters are two identical discs of aluminum (5.6 cm diameter). The lower disc is fixed, while the upper is movable by using a screw to ensure good electrical contacts between the electrodes and the sample; this enables us to avoid the parasite capacitance induced by the presence of air interstices at the interfaces between the sample and the electrodes. The thermocouples were used to record the temperature are not attached to the capacitor plates directly because they may produce a leak which may changes the value of the capacitance, therefore it was set as close as possible to the capacitor plate as the thickness of one mica sheet.

B. Infrared (IR) Measurement

The IR spectra of PTFE polymer was obtained at room temperature in the wave number (450-4000 cm-1) with double beam recording IR spectrometer (Perkin Elmer). For IR measurement the solid PTFE was simply converted to powder form (1 mg) using the saw method.

The KBr and PTFE powder was mixed and then compressed at 10 tones to form 1 mm thick disk for IR analysis.

C. Dielectric and AC Measurement

Dielectric and AC conductivity measurements were performed using Programmable Automatic Precision RCL meter type PM6036. During the experiment, the temperature was measured using Alumel-Chromel constantan thermocouple, which was accurate to ± 1°C, with digital thermometer TM-914C (40~1200°C).

The resistance and capacitance of PTFE sample was measured at different temperatures and different frequencies, from which the dielectric constant, dielectric loss and AC conductivity was calculated by some relations, were presented in later sections.

III. Results and Discussion

A. IR Analysis

Fig. 1 shows the IR spectra of commercial polytetrafluoroethylene (PTFE) at room temperature.

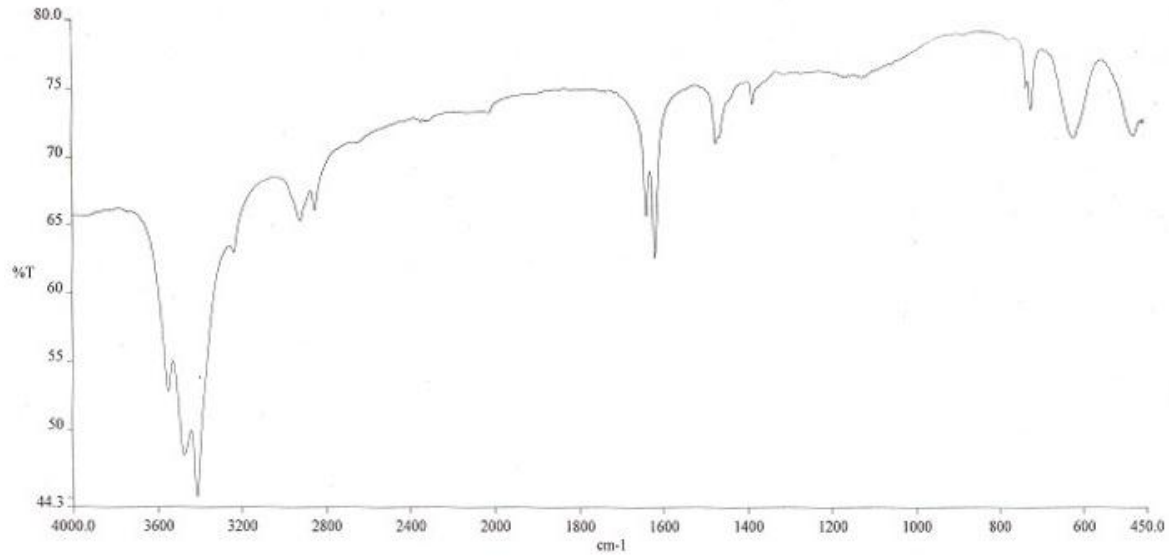

Fig. 1. A photo copy of the measured IR spectra of commercial polytetrafluoroethylene (PTFE) at room temperature.

IR spectroscopy is a popular method for characterizing polymers. This technique is based on the vibrations of the atoms of the molecule (Stuart, 2002). The IR spectra shows a broad band in between 3550 and 2850 cm-1 which can be ascribed to both OH groups and water absorbed by KBr (Lucas, 2000; Macipe, et al., 1999). The bands at 1637 and 1617 cm-1 was non-aromatic double bond stretching C=C. The peak at 1380 cm-1 is attributed to CF bending (Soo-Jin et al., 2003), and the bands at 670 and 595 cm-1 are due to deformation vibrations (F-C-F) of CF_2 bending (Yang et al., 2007). Thus the IR spectrum confirms the existence of unsaturated double bonds in the commercial PTFE sample. The other peaks are due to the impurities exist in the sample especially additives, stabilizers, fillers and many others.

B. Dielectric Analysis

The study of dielectric relaxation phenomena is a powerful tool for understanding of the ion transport behavior and obtaining the information of ionic and molecular interaction in solid polymer (Pradhan, Choudhary snd Samantaray, 2008).

The complex permittivity function:

$$\varepsilon^*(\omega) = \varepsilon'(\omega) + \varepsilon''(\omega) \quad (1)$$

Which is a materials property depending on frequency of the applied field, where $\varepsilon'(\omega)$ a relative permittivity that related to the energy is stored in the material and $\varepsilon"(\omega)$ a dielectric loss which is proportional to the energy that is dissipated in each cycle (Okutan and Şentürk, 2008; Batoo, Kumar and Lee, 2009). The dielectric constant, dielectric loss and AC conductivity were estimated using the following relations (Mohamed and Gadou, 2005; Muhammad, Athar and Tasneem, 2005):

$$\varepsilon' = \frac{L.C}{A.\varepsilon_o} \quad (2)$$

$$\varepsilon'' = \frac{1}{R.C_o.\omega} \quad (3)$$

$$\sigma_{AC} = \frac{L}{R.A} \quad (4)$$

Where C is capacitance of the polymer sample and:

$$C_o = \frac{\varepsilon_0.A}{L} \quad (5)$$

ε_o is the permittivity of free space (8.85×10-12 F/m). A and L are the active area of the sample and its thickness, respectively, and *R* is the resistance of the polymer sample. ω is the angular frequency and is given by; $\omega = 2\pi f$.

The relative permittivity curves of PTFE sample versus frequency at different temperatures are presented in Fig. 2. Dielectric properties are a complex function of bulk permittivity, conductivity, size, shape, spatial arrangement of the constituents (the filler, platicizer and the matrix) and the testing frequency and temperature (Yang, et al., 2007).

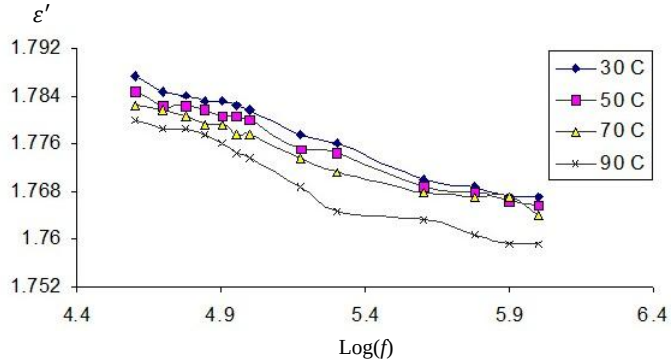

Fig 2. Frequency dependence of relative permittivity (ε′) at different temperatures for commercial PTFE.

It can be observed that for this nonpolar polymer, the relative permittivity is slightly frequency dependent, with a slight decrease as frequency increases from 10 KHz to 1 MHz. There are three types of polarization electronic, ionic and orientation. Dielectric materials ordinarily exhibit at least one of the mentioned polarization types depending on the material and also the manner of the external field application (Kuntaman and Ayten, 2002; Kittel, 2005), polymers such as polystyrene and PTFE, have no polar groups so its permittivity reflects the displacement of electrons relative to nuclei, i. e., electronic polarization when an AC electric field is applied (Kuntaman and Ayten, 2002). The decrease of relative permittivity with increasing frequency due to the dielectric dispersion as a result of the lag of molecules behind the alternation of the electric field at high frequency, i. e., there is no enough time for molecules to follow the alternation of the electric field at high frequency (rapid phase orientation) (Nada et al., 2004). The total variation of relative dielectric constant against frequency and temperature is small, its value ranges between 1.766 and 1.789 and this is due to the nonpolar nature of PTFE and in this polymer the electronic polarization is dominant and occurs during a very short interval of time (of order of 10-15 sec.), (Khare and Sandeep, 2000). In general, the variation of relative permittivity with temperature is different depending on the polarity of the polymers. For nonpolar polymers the relative permittivity is known to be slightly affected by temperature as depicted in Fig. 2 ; but in the case of strong polar polymers is completely different, that is, the relative permittivity increases as the temperature increases (Wong, Youterson and Sutherland, 2005). The dielectric loss versus frequency at different temperatures for commercial PTFE are presented in Fig. 3.

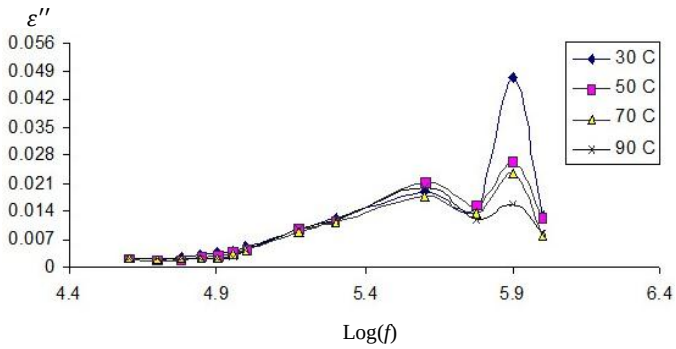

Fig. 3. Frequency dependence of dielectric loss (ε″) at different temperatures of commercial PTFE

It can be seen that at lower frequencies the dielectric loss (Fig. 3) is small but when the frequency is increased the dielectric loss is increased as well as some loss peaks are appeared which can be attributed to the presence of impurities and carbon double bonds as confirmed in IR study (Fig. 1). The increase of dielectric loss with increasing frequency can be explained as follow: as the applied frequency increases, the inertia of the charged particles tends to prevent the particle displacements from keeping in phase as the field changes. This leads to a frictional damping mechanism that causes power loss, because work must be performed to overcome

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these damping forces. Most dielectrics, including ceramics and polymers, exhibit low loss at low frequencies but become lossy at high frequencies (James, 1998). Low values of ε" (0.0021-0.0473) of PTFE are indicative of minimal conversions of electrical energy to heat and little overall energy loss. Regarding the peaks observed in Fig. 3 which due to the presence of unsaturated double bond $(C = C)$ as confirmed by IR study and polar additives which may introduce dipole moments in PTFE, which may couple the molecular motions of a present sample to the external field and produce the γ and β-dielectric relaxation peaks which shift to high frequency. It can be observed that the peaks are broad and they are not symmetrical about its maximum, this suggests the fact that these peaks are due to distributed relaxation.

The dielectric loss versus relative permittivity (Cole-Cole plot) at temperatures 30 ºC and 70 ºC are presented in Fig. 4 and Fig. 5. The shapes of the curves indicate that there are two different relaxations are contributing to the relaxation data. The Cole-Cole plots shows a broad dispersion for ε" - ε' curve, which is correspond to a distribution of relaxation time and we have a lower loss maxima than those predicted by the Debye model and the ε" - ε' curves not falls inside the semicircle. The Cole-Cole plots from 30 to 70 ºC inform us that the relaxation even in this temperature range cannot be described by single Debye relaxation. According to Debye model the ε" versus ε' must give a semicircle with a diameter coincides with the x-axis. Thus a non-Debye type relaxation can be concluded in commercial PTFE sample. In solid polymers, the dielectric response departs noticeably from the Debye behavior. The full width at half maximum (FWHM) is 0.007 and 0.008 at temperatures 30º C and 70º C respectively. Thus the FWHM of dielectric loss peaks are significantly smaller than 1.144 decades as predicted by the Debye model. In many cases the loss peaks are also observed to be asymmetric about the maximum peak frequency f_p (Dilip, 1994), as it can be seen in the present work (Fig. 4 and Fig. 5).

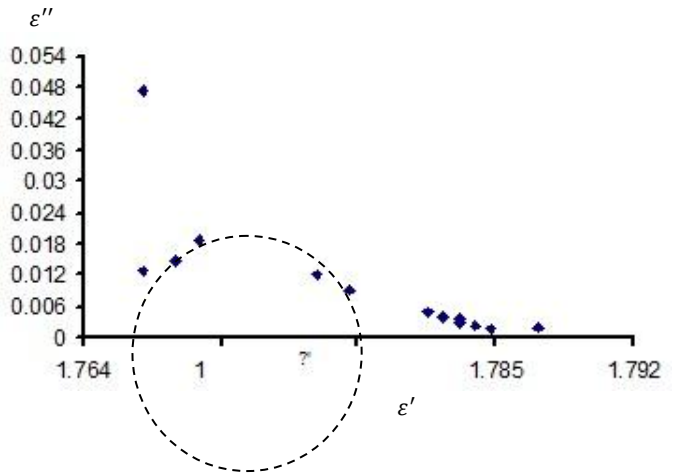

Fig.4. Cole-Cole (ε'' versus ε') plot at 30°C.

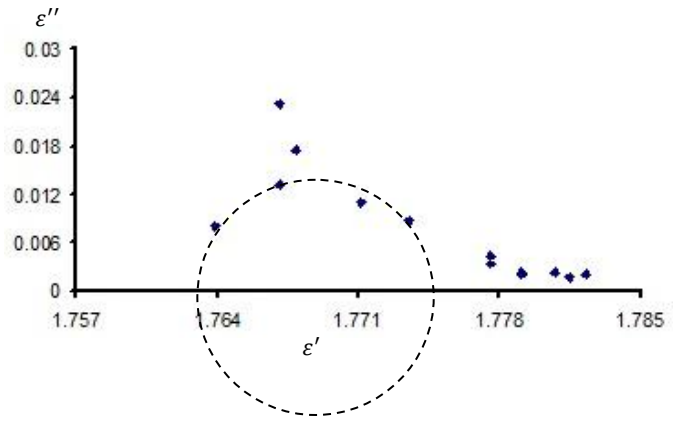

Fig.5. Cole-Cole (ε'' versus ε') plot at 70°C.

C. *The AC Conductivity Analysis*

Fig.6 shows the frequency dependence of AC conductivity at different temperatures.

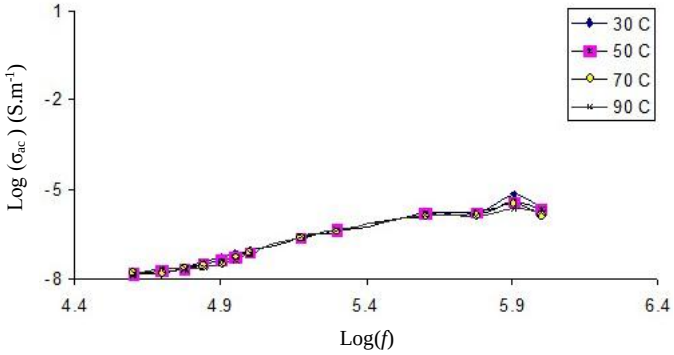

Fig. 6. Frequency dependence of AC conductivity at different temperatures of commercial PTFE.

It is clear that the AC conductivity increase with increasing of frequency almost linearly. The deviation from the linearity at higher frequencies is ascribed to dispersion of molecules. The increase in AC conductivity with frequency and weak temperature dependence indicate that charge carriers are transported by hopping processes through defect sites along the chain (Vijayalakshmi, Ashokan and Shridhar, 2000). The variation of AC conductivity with temperature at different frequencies is presented in Fig. 7.

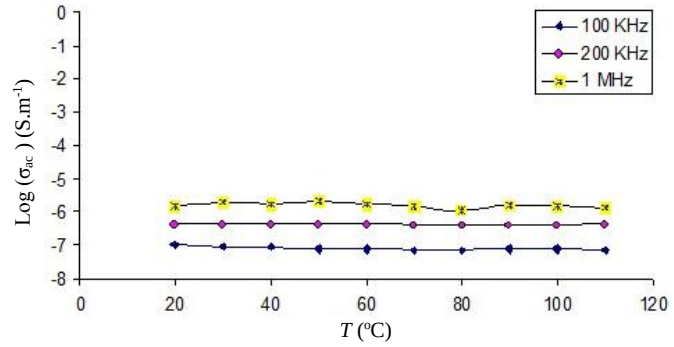

Fig. 7. Temperature dependence of AC conductivity at different frequency of commercial PTFE.

As it is clear from Fig. 7 that the AC conductivity is almost temperature independent, but it can be observed that the AC conductivity increases with increasing frequency and has the higher value at 1MHz. This is due to frequency dependent of AC conductivity ($\sigma_{AC} = 2.\pi.f.\varepsilon_o.\varepsilon''$) (Tony and David, 2005; Saravanan, Anantharamanand and Venkatachalam, 2006).

IV. CONCLUSION

The relative permittivity decreases with increasing frequency which can be attributed to the occurrence of dielectric dispersion, while its decrease with temperature can be ascribed to the temperature dependence of specific volume of the commercial PTFE sample. The appearance of some peaks in dielectric loss spectra are due to unsaturated double bonds ($C = C$) and many other impurities, which indicating the dielectric relaxation phenomena. From the ε" spectra measurement we conclude that the commercial PTFE is a low loss material. The uncompleted semicircle between ε' and ε" and the calculated value of FWHM at different temperatures reveal the non-Debye relaxation processes in PTFE sample. The increase of AC conductivity with increasing frequency is due to charge carrier's conduction via hopping process.

ACKNOWLEDGMENT

We are grateful to thank Dr. Emad A. Al-Khafagy for IR analysis. Great thanks due to Salaadin University, Physics department, for LCR meter equipment.

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ARO ISSN: 2307-549X DOI: 10.14500/2307-549X

Koya University is located in the city of Koya (Koysinjaq), which is 1.0 hr drive to the East of the Kurdistan Region capital Erbil (Arbil, Hewlér) in North Iraq. It is on the foot-hills of beautiful high mountain. Its campus has been carefully laid out to embrace the beautiful mountainous nature.

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ARO the Scientific Journal Office
Koya University University Park
Danielle Mitterrand Boulevard
Koya KOY45
Kurdistan Region - F.R. Iraq

ISSN: 2307-549X (DOI: 10.14500/2307-549X)