JOURNALOS

Volume 1, No. 1, September 2007

ISSN: 219 318 11

JASRI

Journalos of Advanced Scientific Research and Innovation

Germany, 2007

Long term addition of organics to sustain the system productivity of Rice (*Oryza sativa* L.) –Wheat (*Triticum aestivum* L.) under Indo-Gangetic Plains of India

D. K. SINGH*[1], P. C PANDEY[2] AND SHILPI GUPTA[3]

Department of Agronomy, College of Agriculture, G. B. Pant University of Agriculture & Technology, Pantnagar – U S Nagar-263145, Uttarakhand (India)

*[1]Professor and Corresponding author, Department of Agronomy, College of Agriculture, G.B.P.U.A.& T., Pantnagar, U.S. Nagar, Uttarakhand-263145, India,

[2]Professor (E-mail: pooranagro@rediffmail.com), Department of Agronomy, College of Agriculture, G.B.P.U.A.& T., Pantnagar, U.S. Nagar, Uttarakhand-263145, India,

[3] Senior Research Fellow, Department of Agronomy, College of Agriculture, G.B.P.U.A.& T., Pantnagar, U.S. Nagar, Uttarakhand-263145,

Note: The research was supported by Indian Council of Agricultural Research(ICAR), INDIA

ABSTRACT

To find out the effect of organic inputs on productivity, soil fertility and sustainability in rice-wheat rotation, a long term field experiments were started from the year 1986 at G.B.P.U.A &T, Pantnagar (India) on silty loam soil and after 10 years of continuous research in the same experiment, the study of another eleven years (1998-2009) on rice–wheat crop cycles were undertaken. Application of Sesbania green manure along with FYM significantly enhanced the average grain yield of rice (5.96 t/ha), wheat (4.71 t/ha) and average total system productivity in terms of rice equivalent yield (11.68 t/ha). Soil fertility status was also significantly enhanced over control and recommended dose of fertilizers. The sustainability index for rice – wheat system was highest (0.90) with 100 % use of organic nutrient sources i.e. Sesbania along with FYM treatment on long term basis over control and recommended NPK. Currently there is growing concern about the sustainability of rice-wheat cropping system as the growth rate of rice and wheat yield either stagnating or declining. The combination of poor soil fertility and inadequate, unbalanced, and inefficient use of fertilizers contributes much to this problem. Therefore, here we demonstrate that the continuous use of either 100 % of organic nutrient sources i.e. Sesbania green manure + FYM or organics along with recommended doses of NPK sustained the system productivity of rice – wheat and also maintain the soil health through maintaining soil physical and biological properties in Indo – Gangetic plains of India.

Keywords: Rice- wheat, Green manure, FYM, System productivity, Sustainability index, Indo-Gangetic plains

1. Introduction

The Indo- Gangetic Plains occupies nearly one-sixth of the total geographical area of the sub-continent and is home to nearly 42 per cent of the total population of 1.3 billion of South Asia. The population is increasing at about 2.0 per cent per year, representing 24 million more mouths to be fed annually. Rice-wheat rotations are practiced on nearly 13.5 million ha (Ladha *et al*, 2000) with another 12 million ha in China. In South Asia that is almost one-sixth of the cultivated area, and rice-wheat cropping produces more than 45 per cent of the region's food. Demand for rice and wheat will grow at 2.5 per cent per year over the next 20 years. At the same time, the per capita rice-wheat growing area has shrunk from 1,200 m^2 in 1961 to less than 700 m^2 in 2001. Thus, future growth in food production will have to come from yield increases.

The Indo-gangetic plains climate is sub-humid with a distinct wet monsoon summer season and a dry, cool winter season. This allows rice and wheat to be grown in a double cropping pattern in one calendar year, rice in the summer and wheat in the winter. Temperature can exceed 45^{o}C in the summer and frost occurs in some areas in the winter. Soils are mainly alluvial, as a result of depositions of the Indus and Ganges river systems. Many soils are alkaline, although acid soils are also present in the piedmont and some floodplains. Soils range in texture from loamy sands to silty clay loams. The Indo-Gangetic plains are endowed with extensive canal irrigation systems using water storage reservoirs in the Himalayan mid-hills. Canal irrigation is supplemented with tube-well water and most of the rice-wheat areas are irrigated or partially irrigated. The Indo-Gangetic plains is probably one of the most fertile and productive agricultural areas in the world. Rice and wheat are grown annually in sequence on more than 13.5 million hectares in the Indo-Gangetic Plains of South Asia, where the rice-wheat rotation is vital for food security and livelihood for millions of rural and urban people. This cropping system so far has maintained the balance between food supply and population growth but recent evidence shows that productivity and sustainability of this system is threatened as yield of both rice and wheat are either stagnant or decreasing and total factor productivity is declining for the following reasons: inefficiencies in the current production system, increasing shortage of resources especially water and labor, changing climate and socioeconomic changes such as urbanization, labor migration, preference of nonagricultural work, rapid economic growth led to increased labor requirement in nonagricultural sectors (Ladha *et al.,* 2003).

During the last several decades, the rice (*Oryza sativa*) –wheat (*Triticum aestivum*) based cropping system in India significantly contributed in enhancing the food grain production & achieving the food self sufficiency & food security. The rice-wheat cropping system is the backbone of India's food security. The magnitude of the contribution of rice-wheat cropping system to the country's food security can be gauged from Punjab alone, which has less than 2% of the country's cultivated land, and provides 60% of the wheat and 40% of the rice to the Public Distribution System and national buffer stocks (Swaminathan, 2007). The rice-wheat cropping system is India's most widely adopted system, covering over 10.5 million hectare mostly in the country's north-west zone (Paroda *et al.,* 1994). The average productivity of the country of both rice and wheat is low 2,130 and 2,670 kg/ha, respectively. Currently there is growing concern about the sustainability of RWCS as the growth rate of rice and wheat yield either stagnating or declining (Paroda 1996). The

combination of poor soil fertility and inadequate, unbalanced, and inefficient use of fertilizers contributes much to this problem (Yadav *et al.,* 2000; Dwivedi *et al.,* 2001). Continuous rice- wheat cropping without adequate and balanced nutrition has resulted in a widespread problem of multiple nutrient deficiencies (Timsina and Connor, 2001).

2. Materials and Methods

The long term field experiment was initiated during 1988- 89 and after 10 years of continuous research in the same experiment, the study of another eleven years (1998-2009) on rice–wheat crop cycles were undertaken in the experimental farm of Norman E. Barlough Crop Research Centre at G. B. Pant University of Agriculture and Technology, Pantnagar, district Udham Singh Nagar, Uttarakhand in the *Tarai* region of Indo- Gangetic Plains. It lies at 243.8 m above from sea level, about 30 km southward of foothills of Shivalik range of Himalayas at 29^0 N latitude, 79^0 29^0 E longitude with sub humid, sub tropical type of climate. The soil of experimental field at the beginning of the experiment (1988-89) was silty loam in texture, rich in organic carbon (1.22 %), medium in available nitrogen (336 kg/ ha), phosphorus (20 kg/ ha) and potassium (216 kg/ ha). The experiment included two crops per year under rice-wheat cropping system. The treatments which were arranged in a complete randomized block design with three replications included unfertilized control, application of recommended NPK ($N_{120}P_{60}K_{40}$ - **T_1**), application of N_{180} P_{60} & K_{40} (**T_2**), *Sesbania* + FYM@ 5t/ha for rice (as starter dose to green manure crop) & FYM @ 10t/ha for wheat (**T_3**), $N_{120}P_{60}K_{40}$ (N through neem coated urea) (**T_4**), $N_{120}P_{60}K_{40}$ (**T_1**)+ straw mixed@ 4t /ha (**T_5**), *Sesbania* with P & K (60: 40) for rice & recommended NPK ($N_{120}P_{60}K_{40}$) for wheat (**T_6**) and $N_{120}P_{60}K_{40}$ (T_1) + straw burnt@ 4t /ha (**T_7**).

Wherever the green manuring treatment was there, *Sesbania* grown *in- situ* before rice transplanting and incorporated 40- 60 days after sowing. Prilled urea (N@ 120 kg/ha) along with wheat straw @ 4 t/ ha was mixed to soil before rice transplanting. Straw of wheat was burnt and mixed into top 15 cm soil before 20- 25 days of rice transplanting and the plots were irrigated. Similarly, rice straw was used before wheat sowing. FYM @ 5 t/ ha and @ 10 t/ ha for rice and wheat, respectively was applied just 25 days before planting in treatment **T_3**. In treatments **T_1**, **T_2**, **T_4**, **T_5** and **T_7**, half dose of N and full dose of P & K was applied at the time of field preparation i.e. previous day of planting. Rice variety Pant dhan-4 and wheat variety UP-2338 was used for experimentation. In case of rice nursery sowing and transplanting was done in June and in wheat, the crop was sown in first week of December. *Sesbania* was incorporated as green manure prior to basmati rice only. All the agronomic practices and plant protection measures were followed as per standard recommendations. Rice crop was harvested on last week of October and wheat crop was harvested on first fortnight of April, every year.

2.1 Sampling and Analysis of Soil

Soil samples were collected from the surface layer (0-15 cm) of all the plots after the completion of crop cycle in April, every year. Soil samples were air dried and ground to pass through a 2 mm sieve. All soil meant for chemical analysis were stored at room temperature until required for analysis. Soil organic carbon was determined by the method of Walkley & Black (1934) as described by Jackson (1967) and expressed in percentage (%). Available nitrogen in soil was determined by alkaline $KMnO_4$ method (Subbiah and Asija, 1956) and expressed in terms of kg ha^{-1}. Available

phosphorus in soil was determined by 0.5 M $NaHCO_3$ (pH 8.5) extraction method (Olsen *et al.*, 1954) and available potassium extracted by neutral normal ammonium acetate method (Pratt, 1965) and concentration in aliquot was determined by flame photometer. All chemical results were given as means of triplicate analysis.

2.2 Grain Yield

Grain yield of rice and wheat was determined from the net plot area by harvesting all the tillers and hills excluding the border line area. The grain were separated from the straw, dried & weighed.

2.3 System Productivity

Data on grain yield was recorded after each season of crop harvest and system productivity in terms of rice grain equivalent yield (RGEY) was evaluated using equation i.e RGEY (q/ha) = rice yield + {(yield of rabi crop X price of rabi crop)/ price of rice}

2.4 Sustainability Index

Sustainability index was calculated to assess soil quality under the influence of different fertilizer management practices and was evaluated using the equation i.e. Sustainability Index = {(Mean yield- standard deviation)/ MaximumYield}.

2.5 Statistical Analysis

All the data using samples from replicate field plots for each treatment was analyzed statistically. Analysis of variance (ANOVA) was done to determine the effect of treatment using Gomez and Gomez (1984). Critical Difference (C.D.) values were calculated using standard errors of mean (S.Em.±) at 5 per cent level of significance.

3. Result and Discussion

3.1 Trends in Rice yield

Yield of rice during 11 years resulted to a significant effect of different nutrient treatments applied to them (Fig.1). Grain yield for all the treatments were greater than the un- amended control. During 1998- 2002 rice yield was highest with the $N_{180}P_{60}K_{40}$ treatment which was *at par* with recommended NPK (T_1), use of *Sesbania* in combination with FYM treatment (T_3), *Sesbania* with P & K (60: 40) for rice and recommended NPK ($N_{120}P_{60}K_{40}$) for wheat (T_6) and recommended NPK with straw burnt (T_7). Lower grain yield in the plots amended with green manure & FYM may have been associated with the less available nutrients in the initial years of transition as nutrient processes in first year organic systems change from inorganic N fertilization to organic amendments and this effect has been widely studied (Harris *et al.*, 1994) and slower release rates of organic materials (Liebhardt *et al.*, 2000; MacRae *et al.*, 1990). However, after 11 years the maximum mean yield was recorded with the use of *Sesbania* in combination with FYM treatment (5.96 t/ha) than did any other treatments. This increase in grain yield after continuous use for six years with FYM application has been found to be associated with the better root development and more root length density responsible for increasing the capacity of rice plant to extract nutrient from deeper soil layers. Moreover, this organic manure might have helped in improving nutrient availability from soil for a prolonged period, which ultimately increased the crop yield and this is also studied (Nayak *et al.,* 2007). The increase in grain yield of rice over recommended doses under different treatments ranged from 5 to 25%.

3.2 Trends in wheat yield

Overall yield of wheat was low in almost all fertility treatments which may be attributed to late sowing of wheat (generally during first fortnight of December) which is general phenomenon of rice-wheat cropping system in Indo- Gangetic Plains. Highest grain yield of wheat was recorded in FYM (T_3) for the first two years of experimentation which was *at par* with the application of recommended NPK (N through NCU). In 2000-01, it shifted towards $N_{180}P_{60}K_{40}$ (T_2) which was statistically *at par* with T_1, T_3 & T_6. In the year 2002-03 significant higher yield was obtained again with $N_{180}P_{60}K_{40}$ (T_2) which was statistically *at par* with T_1 & T_3. During the year 2005-06 to 2008-09 significantly higher yield was recorded with FYM treatment than all other treatments. Long term study showed that there was a regular decrease of wheat yield after 2002-03 till 2008- 09 with recommended dose of NPK and $N_{180}P_{60}K_{40}$, this may be due to limiting factor of micronutrient and other soil properties. Same trend was also observed by Yang *et al.*, 2011. However, the wheat yield was regularly increasing after 2002-03 till 2008-09 with the application of FYM (T_3). This may be due to the effect of higher levels of organic matter, which improves soil physical & chemical properties and add significant quantities of N, P, K, Ca and Mg (Edmeades, 2003). (Fig. 2)

3.3 Total System Productivity

Total system productivity (average of 11 years) was observed to be higher in all the treatments as compared to the control and recommended NPK dose (Fig. 3). The treatment where *Sesbania* + FYM to rice and FYM (10 t/ha) to wheat were applied, recorded much higher system productivity (11.68 t/ha) followed by $N_{180}P_{60}K_{40}$ (T_2) and $N_{120}P_{60}K_{40}$ + straw burnt @ 4t /ha (T_1). However, lowest system productivity after control (4.00 t/ha) was recorded with recommended NPK (9.11 t/ha), N through NCU (T_4).

3.4 Sustainability Index

Sustainability index was observed to be higher in all the treatments as compared to the control and recommended NPK dose (Fig. 4). Sustainability index was calculated to assess soil quality under the influence of different fertilizer management practices. The long-term application of organic manures in rice-wheat cropping system increased the index value because it increased the nutrient index, microbial index and crop index of soils (Kang *et al.*, 2005). The use of only chemical fertilizers in the rice-wheat cropping system resulted in poor soil microbial index and crop index. In rice- wheat system, additional application of FYM at 10 t ha^{-1} before sowing wheat made the system more sustainable than application of $N_{120}P_{60}K_{40}$ the sustainability index values were 0.90 (the highest for this system) and 0.76, respectively.

3.5 Soil Properties

After 11 years of completion of crop cycle, results (Table 1) revealed that the application of *Sesbania* green manure maintained the organic carbon (1.23 %) than other treatments which was found to be *at par* with T_5 (recommended NPK with straw mixed), T_6 (*Sesbania* with P & K (60: 40) for rice and recommended NPK ($N_{120}P_{60}K_{40}$) for wheat) and T_7 (recommended NPK with straw burnt). The increase of organic carbon in organic system is very slow (Clark *et al.*, 1999). In all other treatment there was a significant decline in the organic carbon per cent and this might be due to the continuous cropping of rice and wheat.

Significantly higher available nitrogen was recorded with *Sesbania* + FYM treatment followed by T_4 and T_5 and lowest was recorded under control. FYM and *Sesbania* amended plots had higher content of available phosphorus than other treatments; this was due to residual accumulation of nutrient applied through organic sources. Lower availability of plant nutrient in plots applied with organic amendments was expected due to the slower release of organic material, particularly during initial years (Liebhardt *et al*., 2000, MacRae *et al*., 1990). However, with the time it showed successive increase. Available potassium was significantly higher when straw was burnt as burning leads to direct addition of potassium (at least 40 kg/ha) followed by T_3, similar results were observed (Clark *et al.*, 1999 and Reganold *et al.,* 2001). The role of green manuring as a source of organic matter and nitrogen and its capacity to mobile soil phosphorus and other nutrients is well recognized. Studies conducted by Gupta (1998) indicated that green manuring increased the available N, P and K content of soil to the extent of 61, 107 and 75 percent, respectively.

4. Conclusion

Organic farming opens up the prospects of producing high yield, grain quality and adequate soil fertility by using organic amendments as compared to inorganic/ chemical fertilizers on long term basis. The long term application of organics invariably led to increase in productivity and can boost better energy and environmental balance and makes a substantial contribution to conserving agricultural diversity and therefore, incorporation of green manure and/or farm yard manures were found to be beneficial to build up the soil organic matter and sustain the productivity of the system.

References

Clark, M.S., Horwath, W. R., Shennan, C., Scow, K.M., Lanini, W.T. and Ferris, H. (1999). Nitrogen, weeds and water as yield limiting factors in conventional, low input and organic tomato systems. Agriculture Ecosystem & Environment, 73, 257- 270.

Dwivedi, B.S., Shukla, A.K., Singh, V.K., Yadav, R.L. (2001). Results of participatory diagnosis of constraints and opportunities (PDCO) based trials from the state of Uttar Pradesh. In: A. Subba Rao & S. Srivastava (Eds.), Development of Farmers' Resource-Based Integrated Plant Nutrient Supply Systems: Experience of a FAO–ICAR–IFFCO Collaborative Project and AICRP on Soil Test Crop Response Correlation (pp 50–75). IISS, Bhopal, India.

Edmeades, D.C. (2003). The long term effects of manures and fertilizers on soil productivity and quality: A Review. Nutrient Cycling in Agroecosystems, 66, 165- 180.

Gomez, K.A. and Gomez, A. (1984). Statistical Procedures for Agricultural Research (21 ed.). John Willey and Sons, New York .

Gupta C (1998) Integrated use of organic manures with urea fertilizers in lowland rice. PhD Thesis, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttar Pradesh

Harris, G.H., Hesterman, O.B., Paul. (1994). Fate of legume and fertilizer nitrogen- 15 in a long term cropping experiment. Agronomy Journal, 86, 910- 915.

Jackson, M.L. (1967). Soil Chemical Analysis, Prentice Hall Pvt. Ltd., New Delhi, India. pp.498.

Kang, G.S. and Beri, V., Sidhu, B.S., Rupela, O.P. (2005). A new index to assess soil quality and sustainability of wheat-based cropping systems. Biology and Fertility of Soils, 41 (6), 389-398.

Ladha, J.K., Fischer, K.S., Hossain, M., Hobbs, P.R., Hardy, B. (2000) Improving the productivity of rice-wheat systems of the Indo-Gangetic Plains: A synthesis of NARS-IRRI partnership research. IRRI Discussion Paper No. 40

Ladha, J.K., Hill, J.E., Duxbury, J.D., Gupta, R.K., Buresh, R.J. (2003) Improving the productivity and sustainability of rice-wheat systems: Issues and Impact. American Society of Agronomy Special Publication 65. Madison, Wis. (USA): ASA, CSSA, SSSA. 211 p

Liebhardt, W.C., Andrews, R.W., Culik, M.N., Harwood, R.R. (2000). Yields and nutrient budgets under compost, raw dairy manure and mineral fertilizer. Compost Sci Util, 8, 207- 216

Mac Rae, R.J., Hill, S.B., Mehuys, G.R., Henning, J. (1990). Farm scale agronomic and economic conversion from conventional to sustainable agriculture. Advances in Agronomy, 43, 155-198

Nayak, D.R., Babu, Y.J., Adhya, T.K. (2007). Long-term application of compost influences microbial biomass and enzyme activities in a tropical Aerie Endoaquept planted to rice under flooded condition. Soil Biology and Biochemistry, 39, 1897-1906.

Olsen, S.R., Cole, C.V., Watanabe, F.S., Dean, L.A. (1954). Estimation of available phosphorous in soils by extraction with sodium bicarbonate. U.S., Washington; D.C. Circ. 939:49

Paroda, R.S. (1996). Sustaining the Green Revolution: new paradigm. In: B P Pal memorial lecture in 2nd International Crop Science Congress, New Delhi, 22 November

Paroda, R.S., Woodhead, T. and Singh, R.B. (1994). Sustainability of rice–wheat production systems in Asia'. In: RAPA Publication 1994/11, FAO Regional Office for Asia and the Pacific, Bangkok, Thailand, pp. 209

Pratt, P.F. (1965). Potassium. In: Methods of Soil Analysis, Vol. II. Chemical and Biological Properties. American Society of Agronomy, Madison, USA. pp. 1023-1030

Reganold, J.P., Glover, J.D., Andrews, P.K., Hinman, H.R. (2001). Sustainabilty of three apple production systems. Nature, 410: 926- 929.

Subbiah, B.V. and Asija, G.L. (1956). A rapid procedure for estimation of available nitrogen in rice soils. Current Science, 25, 259:260

Swaminathan, M.S. (2007). Presidential address, National Academy of Agricultural Sciences, 6th January, 2007, New Delhi

Timsina, J. and Connor, D.J. (2001). The productivity and management of rice-wheat cropping systems: issues and challenges. Field Crops Research, 69, 93-132.

Walkley, A. and Black, T.A. (1934). An examination of the Degtjareff method for determinig soil organic matter and a proposed modification of the chromic acid titration method. Soil Science, 37, 29-38

Yadav, R.L., Dwivedi, B.S., Prasad, K., Tomar, O.K., Shrupali. N.J., Pandey, P.S. (2000). Yield trends and changes in soil organic C and available NPK in a long term rice-wheat system under integrated use of manures and fertilizers. Field Crops Research, 68, 219-246

Yang, X., Yang, Y., Sun, B and Zhang, S. (2011). Long term fertilization effects on yield trends and soil properties under a winter wheat- summer maize cropping system. African Journal of Agricultural Research, 6 (14), 3392- 3401

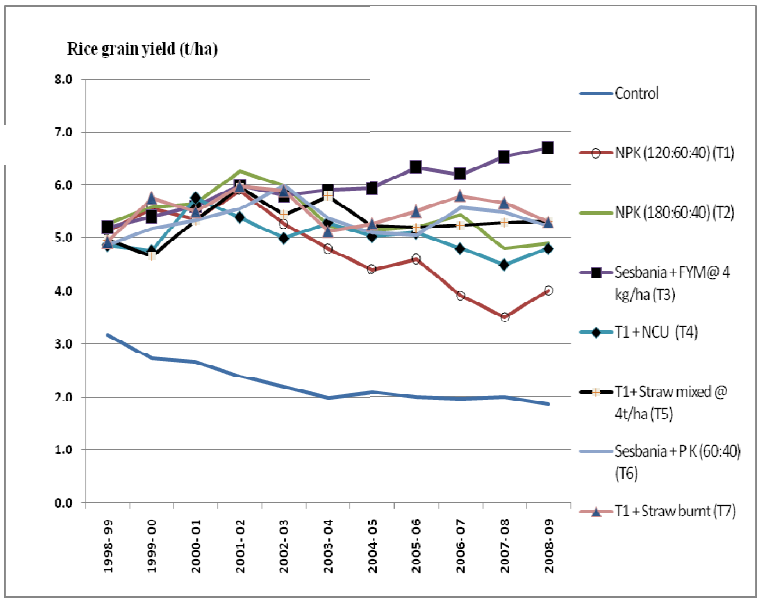


Figure1: Rice grain yield of 11 years as influenced by different fertility treatments.

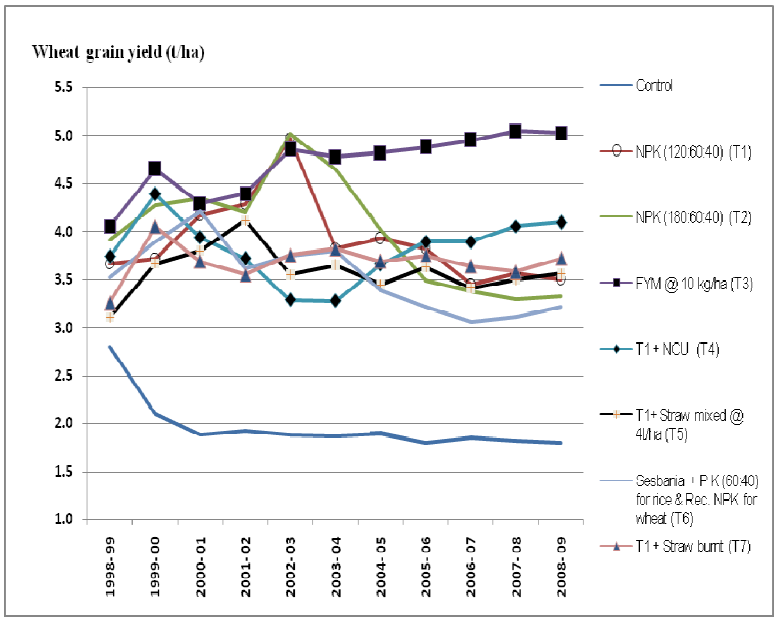


Figure2: Wheat grain yield of 11 years as influenced by different fertility treatments

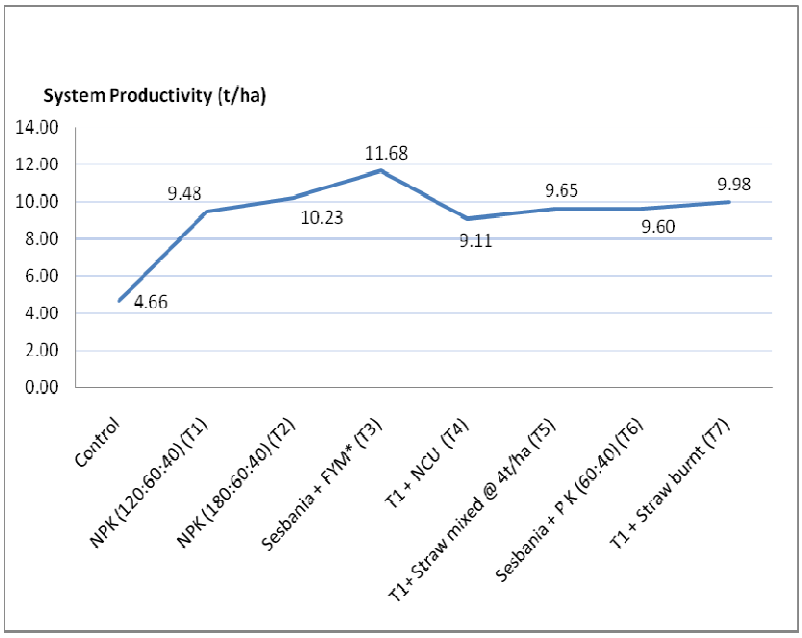


Figure 3: Total system productivity in terms of rice grain equivalent yield of 11 years in continuous rice-wheat crop cycle.

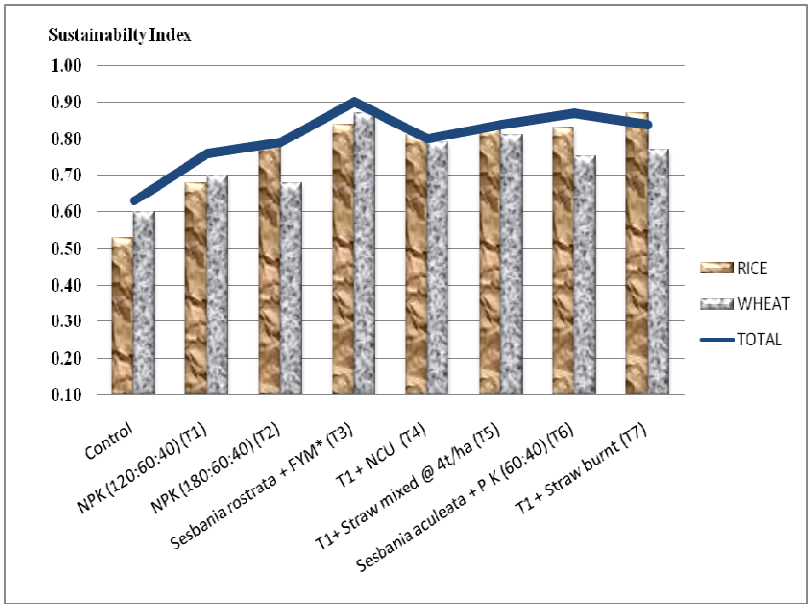


Figure 4: Sustainability index of different fertility treatments after 11 years of experimentation

Table 1: Organic carbon and available nutrient status of soil as influenced by different fertility treatments after 11 years of rice-wheat crop cycle.

Treatments	Organic carbon (%)	Available N (kg/ha)	Available P (kg/ha)	Available K (kg/ha)
Control	0.84	145.6	12.8	173.5
T_1	0.97	351.2	24.0	201.4
T_2	0.95	359.5	24.1	197.5
T_3	1.23	373.7	30.7	209.8
T_4	0.96	367.5	27.2	193.9
T_5	1.16	367.1	25.2	206.0
T_6	1.21	353.0	25.9	199.0
T_7	1.15	357.8	22.7	298.6
SEm ±	0.03	4.54	2.21	0.82
CD(p=0.05)	0.078	13.77	6.71	2.74
Initial	1.22	336.0	20.0	216.0

GENDER EQUITY IN EDUCATION DEVELOPMENT IN KENYA AND THE NEW CONSTITUTION FOR VISION 2030

Agnes W. Kibui PhD, Senior Lecturer,University of Nairobi, School of Education

Logamurthie Athiemoolam PhD, Senior Lecturer, Nelson Mandela Metropolitan University, Faculty of Education

Bernard Mwaniki, MA Student in Development Studies, St. Paul's University

Abstract

Gender equity is the impartial treatment of women and men so as to ensure equal enjoyment of privileges and rights allotted to members of either gender. In Kenyan society, this has been a controversial subject since the country earned its independence. The subject is continually quelled by challenges and hindrances that not only make it difficult for the nation to make greater strides on its way to achieve gender equity but also continue to restrict the country's development whether in the political, social or economic spheres as envisioned in the country's economic growth blueprint dubbed Kenya Vision 2030. These challenges include traditional and cultural practices, rapid population growth, religion, poverty, disease and so on. Despite the aforementioned challenges, the country has still made enormous progress in trying to achieve gender equity in all sectors including education development and this is due to various efforts made by all stakeholders towards addressing the many gender issues and concerns experienced in the country. Among the progressive initiatives in this regard is the promulgation of the country's new constitution whose set of laws are aligned towards promoting gender equity and the incorporation of the country's economic growth strategic plan Vision 2030 which recognizes the achievement of gender equity and equality as an important component to driving economic development.

Key Words: **Gender, equity, education, vision 2030**

INTRODUCTION

Gender equity can be defined as the process of being fair or impartial to women and men and this can only be achieved through having strategies and measures in place that counteract the constraints that have blocked men and women in society from playing on a level ground (Wokocha, 2009). This is an unavoidable matter in Kenyan society since gender equity is among one of the many goals the country seeks to achieve in its quest to achieving middle income status within the next two decades. This has been clearly set out in the country's Vision 2030, the country's economic blueprint whose launch in 2009 has seen the country embark on the document's strategies which include having a new constitution in place, a fete already accomplished presently. The promulgation of the country's new constitution can be viewed as one of the greatest achievements in the country's quest for holistic reforms which has seen the enactment of laws in line with the achievement of gender equity in almost all sectors of the country. As discussed in depth later, the constitution has many gender equity gains that provide the required legal backing to ensure that both Kenyan women and men share equal enjoyment of resources, opportunities, rewards and social services (Kariuki, 2011). The various initiatives aimed at addressing the country's gender concerns in the new constitution are also asserted in the country's economic growth plan Vision 2030 and the Government of Kenya's policies as well as Presidential directives. However, there are various hindrances that the country still faces in the achievement of gender equity in education development as envisioned in the strategic plan. Some examples of such barriers are cultural, and religious resistance to gender equity, poverty coupled with disease, rapid population growth, and a lack of sufficient representation in key decision making sectors such as leadership and governance. Some countries in the world have revised their constitution and are ahead of Kenya in making sure that both men and women are given equal opportunities in developing and developed sectors. Some of the strategies these countries have used have been embraced by the Republic of Kenya and others have been engrained into future plans such as Vision 2030 and other departmental and ministerial policies as well as legislations.

Factors that influence gender equity in Kenya

Despite the fact that Kenya has enjoyed relative political stability since it gained independence compared to other developing countries especially in Sub Saharan Africa, the East African nation that has enjoyed fifty years of self rule has still quite a number of challenges that continue to hinder its development and progression as a whole. This also affects the progress in achieving gender equity and equality. There are quite a number of impediments that have continued to restrict progress in the achievement of gender equity in the country and these include factors such as disease, poverty and culture as well as politically enhanced restrictions such as corruption, a lack of good representation among many others.

Cultural factors

The present urban population in Kenya signifies a great contrast in this society's day to day activities as compared to the traditional and cultural heritage that this society emanated from when it achieved its independence. Despite this achievement, there is a lot that has not changed in the whole of Kenyan society with regard to gender equity. There is a general low status that is traditionally given to the female gender which has resulted in a hard-to-overcome inequality between women and men and this is in spite of the continued support from the government which has enacted a number of legislations as

well as forming and effecting policies that are in favour of the fair treatment of women. There have also been various non-governmental organizations that have continued to fight for this cause with large support from the media fraternity, and human rights organizations but all that has not had much effect on getting rid of the tension that lies between the traditional and modern rules in Kenyan society. This traditionally bestowed lower stature affects various sectors of the society such as education, and this has resulted in the female gender being less empowered generally since the general perception of women's roles according to tradition is that they are to be wives and mothers who should stay at home and look after the children. Consequently, many of the rural folk will not invest in educating their female children and this greatly reduces the chances of Kenyan women achieving any level of equity to Kenyan men.

Traditionalism and other cultural hindrances towards achieving gender equity in education development are conspicuous in much of Kenyan society particularly in the rural regions of the country. In much of the rural regions where the citizenry has held on to traditional and ethnic cultural beliefs, there is disregard for almost all of the gender equity values and this is particularly worse on the female gender since fundamental rights accorded to every Kenyan woman, man, girl and boy such as the right to basic education are continually overlooked (Society for International Development, 2010). Most girls are affected by traditionalist concepts such as early marriages and occasionally fatal practices such as female genital mutilation (FGM). Much of Kenyan society still needs to understand the importance of educating women so as to prepare them for development and leadership. This in turn would help in achieving gender equity which goes beyond just empowering women. The whole country should be empowered for development to take place. The fact that women's empowerment is key to achieving long term development has been embraced among almost all governments of developing countries and this is due to the crucial role women play traditionally which is essentially managing households.[1]

Population growth Rate

Kenya's population growth rate currently stands at three percent per annum according to the National Coordinating Agency on Population and Development (NCAPD) and this has been noted as one of the many stumbling blocks the country has to deal with in order to achieve gender equity as well as growth in an economic sense.[2] Kenya's lack of family planning is one of the factors that have led to the high population growth rate and this can be faulted on many factors including culture and tradition as mentioned earlier. The traditionalistic culture which views women as mothers and wives will eventually lead to a situation requiring an urgent reduction in the country's population growth if it intends to attain middle level economic status as envisioned in Vision 2030 especially in development sectors such as education as was the case in developed nations in Asia such as Malaysia, Singapore and Thailand which reduced their population growth rates so as to strengthen their economies. This rapid population growth has also alleviated other challenges that also restrict the achievement of gender equity such as poverty and HIV prevalence.

Researchers from International aid agencies like the United States Agency for International Development (USAID) have all noted that the country needs to figure out means to encourage couples within the country to have smaller families if the country is to achieve food security, universal primary education, and primary healthcare for every Kenyan as well as a decrease in maternal and infant mortality rate as planned for in Vision 2030 (Anyangu-Amu, 2010). The Kenyan population stood at 38 Million people in the year 2008 and this indicated that it had grown by a third since the previous count in 1999. From these figures, researchers have come around with projections that take the country's growth rate into account and these projections show that the country's population will continue to rise

reaching 82 million by the year 2040, which is ten years after the planned completion of the implementation of the national economic blueprint Vision 2030. This shows that the country's population growth rate, if not contained soon, will affect the country's future development plans since the size of a country's population always affects how much of the national budget is available for the provision of services including fundamental ones to the citizenry such as education provision hence the hindrance to the achievement of gender equity in the various sectors including education development.

Religion

Although religion is quite well embraced in Kenyan society, it has also been noted to be an impediment to the achievement of gender equity in education development as well as in the development of the country. Religion offers a platform for members of any society to be united and hence brings about peace and control to what would essentially be a catastrophic society but even with this great blessing bestowed on humanity by religion, it still portrays the female gender as being of lower rank than the males and this clearly acts as a constraint to achieving gender equity. For example, in 2004 and 2006, the United Nations Development Programme's (UNDP) Human Development Report which contains the Gender Empowerment Measure rankings showed that the top ten countries worldwide with the highest levels of gender equality are all greatly atheistic nations, while the countries that featured in the bottom ten of the rankings were all highly religious nations that had atheists at insignificant numbers (Palsule, 2009).

Looking at both Christianity and Islam which are the most entrenched religions in Kenya, both religions' dogma are set to encourage the women in society to gain knowledge that will be beneficial to their traditional roles of being good mothers and wives. Some Islamic religious practices like the *purdah* system encourage the seclusion of women and also emphasizes that women need to dress in a manner that conceals them completely.[3] The system essentially restricts students from the female and male genders from working together due to religious beliefs and through this, it also serves to deny the girls an opportunity to gain knowledge and skills in technical and scientific areas that are continually asserted as the main driving forces of the transformation of the country into a middle income economy as laid out in Kenya's vision 2030 (Oparanya, 2010). In Christianity, the catholic denomination does not ordain women into priesthood and does not encourage women leadership in any church organizations. This setback is a hindrance to the country's development.

Poverty

Education throughout the world enhances any type of development since it gives people the knowledge and the skills needed in social, Economic, and political sectors. Women form the majority of the uneducated population in Kenya and as such they are more vulnerable to being victims of poverty. This has continued to contribute to the gender disparity in Kenya and thus poverty is one of the great challenges that will continue to hinder the country's achievement of gender equity as well as middle income status as it has been proposed in the country's Vision 2030. Looking deeper into how poverty restricts the country's progression in terms of gender equity shows how much the aspect has greatly held the country back on the road to development. This poverty which is a result of many other factors such as corruption, natural disasters, poor governance as well as the aforementioned such as rapid population growth and culture has in turn affected many other areas that are of great impact to the country's development. Some of these areas are education, leadership, and health which are viewed as fundamental requirements for development. A lack of these skills affects the society in many ways. For

example, poor parents would prefer investing in a boy's education than in a girl with the belief that the girl will only enrich her husband's family when she gets married. As a result of this ignorance, many women lag behind as they lack basic empowerment avenues that would equip them with skills which would help them make major contributions to the country's development. Poverty in Kenya affects mainly the women as explained above and is experienced in more than one avenue hence making it a challenge for the country (Kombo & Kimani, 2010). Persistent hunger and starvation that affects the country almost every year and inability to access fundamental services such as healthcare, education, shelter, and clean water is presently defined as a humanitarian crisis in Kenya. A lack of these facilities continues to restrict the country's advancement towards attaining gender equity and this is because all the aforementioned factors affect Kenyan women in a worse capacity compared to men since women are more marginalized and excluded.

Transition rates in the education system

Low transition rates of students especially girls has been a great restriction to Kenya in achieving gender equity especially in education development. The result of the low transition rates has led to the decline in the proportion of the females enrolled in schools higher up in the Kenyan education structure and very much significantly in the tertiary institutions such as universities and middle level colleges.[4] Studies done on this aspect indicate that female students' enrollment in public universities is at thirty per cent of the total enrollment and this has also led to the under-representation of female students in technological, scientific and mathematical professional programs. Consequently, this leads to the aforementioned professions being bloated by males thus greatly impeding the achievement of gender equity (Wosyanju, 2009).

Although the Government of Kenya recognizes education as the basic tool required to develop the required human resources so as to improve the quality of life of every Kenyan as envisioned in the country's economic blueprint, the relatively low transition rates, despite efforts made to increase accessibility and equity in the education sector still continue to restrict the country from making gains in terms of gender equity concerns (Society for International Development, 2010). The enrollment rates have been on a steady rise since the implementation of several reforms in basic education which intended to eliminate the gender disparity that continues to affect the sector but sustaining these achievements requires more investment by the government since making basic education easily accessible is not all that the sector needs. The country needs initiatives to quell impediments to raising transition rates such as developing frameworks and policies that will address the issue of making education accessible to children in communities in the arid and semi-arid areas where pastoralists communities and the nomadic culture continue to deny many children, especially girls, their basic right such as education.

Representation of the female gender in key decision making organs

As mentioned earlier in the article, the low transition rates of girls to positions of higher education as well as other factors such as poverty and culture have resulted in the proportion of women in professional positions being quite small in comparison to the fact that in Kenya women account for slightly more than half of the total population. In addition, they also form the majority of the Kenyan electorate. This under representation in the professional scene has resulted in women being quite few in strategic decision making positions as compared to other developing countries, for instance, Rwanda which serves as an ideal example in regard to having equity in representation. The fellow East African

nation had female legislative representation at 48.8% as of 2005 and as it is well known, having representation increases the attention to gender specific areas, such as education development. In Kenya, gender equity still requires a lot of intervention for its achievement to be realized (African Development Forum VI, 2008).

Access and control of resources

Gender inequity in Kenya is driven largely by a lack of access to and control of resources which is highly divided along gender lines in favour of men. The inequality is especially manifested in the discrimination that is involved in the access to basic necessities and services such as education, land, credit financing as well as markets. The country is also experiencing a general decrease in access to formal employment and this definitely affects the women harder than it does the men. A lack of access to opportunities and control over key resources has been fuelled by many factors such as a lack of women representation in the key decision making organs of governance and other aforementioned factors such as culture and traditions. It has also been driven by slow growth the country experienced in the past as a result of poor governance. Slow economic growth significantly impact on the country's poverty hence making the situation worse. As a result, the slow growth acted as an impediment to attaining gender equity or any form of progression in the economic and political spheres of Kenyan society thus further restraining any advancement that the country could make in line with achieving middle income status by the year 2030.

Disease

Disease form part of the many challenges that continue to constrain progress made in gender equity in many sectors of the country. Communicable diseases such as malaria, tuberculosis and HIV/AIDS are greatly propagated by poverty. Since poverty greatly affects women who form the majority of the poor in the country, it shows that women form the large proportion of those vulnerable to disease hence leading to their withdrawal from empowering avenues such as gaining education or employment. This signifies how much diseases form much of the impediments that continue to hold back the achievement of gender equity in education development. Studies on how disease continues to negatively affect gender equity particularly in education development have been conducted in other African countries that share relatively the same stature as Kenya in terms of achieving gender equality. For example, studies conducted in Zimbabwe and the Kingdom of Swaziland indicated that HIV and AIDS continue to have a negative impact on the living and schooling arrangements of children (Boler & Aikman, 2008). This was particularly noted to greatly affect orphaned children especially girls where even general statistics indicated that fewer girls than boys were able to access basic education or advance to higher levels of education. This drawback is also experienced in Kenya which has tried to work on various plans and strategies in order to expand access to education and good health so as to improve the livelihood of the citizens. HIV and AIDS continue to affect gender equity particularly in the development of education. This happens because the disease brings about money and labour shortages and due to gender biased division of labour emanating from cultural and social factors, the girls' schooling is interfered with since they must work in order to provide food for their families. Women and girls in this society are forced to undertake the great pile of household tasks as well as responsibilities such as contributing labour towards preparations in cooking and other related tasks during communal events such as funerals and feasts. This helps them to earn a little income which enables them to buy food for their families. The old women in the society are affected most because they are left with large families to take care of when the young people die from the disease. This shows how diseases such as HIV and AIDS which is regarded

to as a pandemic and continues to show alarming prevalence rates continue to essentially paralyze efforts that Kenya has prepared to undertake towards attaining gender equity.

However, despite the many hardships the country encounters, a lot of achievements have been made. For example, there are many projects that have been completed, while others have been strategized, that will adequately address the issue of gender equity and equality in education development in the country. This will form the basis for the country to have an enabling environment as described in the country's economic blueprint, Vision 2030, which sets sights on "transforming the country into a globally competitive and prosperous nation".

Achievements and future strategies

Kenya has made a lot of achievements in the last nine years when the new government took over power. For example, the promulgation of the country's new constitution as well as the establishment of the country's development blueprint whose objective is to help transform Kenya into a "middle income country that will provide a high quality of life to all its citizens by the year 2030"[5] among many other government policies and legislations are just a few of the many initiatives that aim to address gender equity. This signifies the commitment the country has towards development in gender equity. For instance, the constitution states that thirty per cent of positions in all sectors of development, employment, and leadership should be reserved for women.

Free primary education

Despite the gender disparities that are reflected mainly in completion rates, transition rates, high adult female illiteracy and low academic achievement levels, the governments implementation of free primary education, (FPE) in 2003 brought about an enormous rise in enrollment rates for girls as well as boys. Over the five year period since the implementation of FPE, the average girls' enrolment was forty nine per cent while in 2008, the net enrolment rate for girls was estimated to be at ninety one per cent which was a great improvement (Ojiambo, 2009). With these encouraging figures it is quite clear that the implementation of free primary education offers the required platform for gender equity in education development since the FPE program seeks to empower both boys and girls hence offering the female gender a fair opportunity. The ratification of the country's new constitution made free primary education a right for every Kenyan hence making it illegal for any parents who choose not to send their children to school as opposed to the aforementioned scenario where due to tradition and culture, female education was overlooked.

The scrapping of school fees and provision of free primary education has helped the girl child access education since the parents no longer need to make preference on which child to send to school. This has helped in making progress in achieving gender equity in line with the country's development goals and strategies such as Vision 2030 since most families that had financial constraints would typically have chosen to take boys to school rather than girls. Similarly, the need to have school fees further affects women and girls as they will resort to any means so as to get finances for crucial education. Such means include engaging in negative money making avenues such as prostitution which is risky and exposes them to fatal diseases such as HIV and AIDS. It also exposes them to situations prone to gender based violence (Wosyanju, 2009). Free primary education therefore serves in many ways to counteract the gender disparities in the country but more importantly it shows the commitment of the country to recognizing basic education as a right enjoyed by every child regardless of gender as well as a vital component to driving the country towards attaining middle income status as intended in Vision 2030.

Kenya's new constitution

The country's new constitution was promulgated on 27th of August 2010 replacing the country's independence constitution of 1963. This was a major fete in the country's progress towards achieving reforms in all sectors including the achievement of gender equity. The constitution guarantees equality for women and men in Article 27 which offers equal and full enjoyment of all fundamental freedoms and rights, which include education, while also asserting that both women and men have the right to equal opportunities in every sector and they have the right to equal treatment. The constitution also establishes the Kenya National Human Rights and Equality Commission which has the framework to effectively promote gender equity and equality while also handling gender mainstreaming for the development of the nation. The earlier discussed aspect of under-representation in decision making organs which serves as an impediment towards gender equity in education development is also addressed in the country's new constitution. Although it doesn't create a fifty-fifty gender match, it still creates a considerable representation for either gender which is set at no more than two thirds of public appointments hence guaranteeing women representation in key decision making organs handling leadership and governance such as the National assembly and the soon to be established Senate where they will have the opportunity to advocate for and increase the attention to specific issues affecting the female gender (FIDA Kenya, 2010).

Discrimination has also been greatly addressed in the country's new constitution through various legal measures which provide adequate mechanisms to address gender equity concerns that were notable in the past due to several disadvantages that were essentially targeted towards the systematic discrimination of women. These avenues of systematic discrimination against women particularly restricted and limited them from accessing professional skills through higher learning which in turn limited them from having an equal chance of gaining formal and informal employment as well as restricting them from accessing and controlling key resources for socio-economic empowerment such as land. In addition, equality in the provision and protection of economic and social rights has also been addressed in the recently promulgated Constitution and this serves greatly in addressing various gender concerns that weren't prioritized before. There are also provisions in the constitution that address equality and equity such as Article 43, which provides for equality in access to basic needs such as reasonable housing standards, adequate food of acceptable quality, the highest attainable standards of

health including reproductive health, education, as well as social security. Hence, Kenya's new constitution has set out the needed structures to significantly achieve economic development as laid out in Vision 2030 through acknowledging the importance of gender equity (Kariuki, 2011).

Government policies and legislations

The Government of Kenya has shown its commitment towards the achievement of gender equity and equality in the country through various initiatives such as legislations as well as policies and presidential directives. The aforementioned free primary education program as well as the country's new constitution are among the many initiatives in support of achieving gender equity that the government has fully pledged support for. Other government measures put in place in support of achieving gender equality include the establishment of the Ministry of Gender, Children and Social Development which was a break away from the former Ministry of Gender, Sports, Culture and Social Services, in order to set up efficient mechanisms in support of gender mainstreaming as well as to enhance implementation of international agreements in support of gender equity and equality such as the Millennium Development Goals (MDGs). The ministry also has highly qualified professionals and even though understaffing constrains the implementation of the ministry's strategic plan, it still has departments for services provision in every district in the country and also organs to attain its objective, namely, the Department of Gender and the National commission on Gender. The Ministry of Gender, Children and Social Development also has the responsibility to implement, monitor as well as offer reports on the Republic of Kenya's progress in implementing international treaties and statutes specific to gender concerns such as the aforementioned millennium development goals, the commission on the status of women and the International Convention on the Elimination of all forms of Discrimination Against Women (CEDAW). All the treaties that the country is signatory to have positively influenced the contents of the country's new constitution as well as its strategic economic growth plan, Vision 2030.

Other government initiatives in support of achieving gender equity in education development include the enactment and implementation of various policies such as the National Policy on Gender and Development of the year 2000 which the government implemented due to the need to have a comprehensive and coherent framework to guide gender mainstreaming within the different sectors of government so as to ensure the end to misplacement of enormous national resources (Society for International Development, 2010). A Gender Policy in Education was also developed in 2007 through the Ministry of Education and its intent was to have a framework for the designing and implementation of various gender-responsive education sector programmes such as the measure to raise the levels of gender parity at all the levels of education. Other measures outlined in the policy include using gender responsive research to address gender concerns in the education sector by using institutional capacity, setting up of a gender and education unit, mechanisms to address gender based violence as well as sexual harassment concerns within the education sector, and a framework to monitor and evaluate the progress made during the implementation of the aforementioned measures. Already strategized initiatives that the ministry wishes to use in order to implement the measures include the establishment of a Gender Desk within the ministry, setting up a Ministerial Task Force on Girls' Education and a National Task Force for Gender and Education.

A number of legislations have been enacted in support of addressing gender equity concerns in the country. The employment act of 2007 is one ideal example that addresses many gender concerns through offering provisions such as providing for three months of fully paid maternity leave for pregnant employees, offering legal requirements stipulating that all men and women who perform work of equal

value will be remunerated equally as well and the creation of legal prohibitions to sexual harassment within the 6th section of the bill which clearly defines sexual harassment to include the use of language, whether in verbal or written correspondence, of a sexual nature. Other legislative measure the country has undertaken in the great strides made towards attaining gender equity as well as equality include Sexual offences Act of 2006, the Truth, Justice and Reconciliation Act of 2008, Occupational Safety and Health Act of 2007, the Labour Relations Act of 2007 which all have provisions that are in support of the country achieving gender equity in education development in line with the achievement of middle income status as stipulated in Vision 2030.

Incorporation of Vision 2030

Vision 2030 is a national plan-cum strategy developed by the Government of Kenya under a Presidential directive in 2006 to have the National Vision Steering Committee develop a medium term plan on development programs to be implemented with the promise of driving the country's economic growth till the year 2030. The growth set out in the national plan covering the following two decades has been established on three main pillars which are the political, economic and social pillars. The gender concern addressed in the plan particularly, is the equity in resource distribution and power between the genders. The social pillar which identifies gender issues requiring attention has its goal as achieving "a just and cohesive society enjoying equitable social developments in a clean and secure environment"[6]. The plan's social pillar also highlights the various areas of inequality in the economic, political and social spheres and has strategies in place as well as set targets which include initiatives like gender mainstreaming and the initialization of gender responsive budgeting (GRB) which has turned out to be a success in other African countries where it has been implemented such as Rwanda, Uganda and South Africa. Similarly, several strategies have been put in place to address the gender concerns in Vision 2030 as it seeks to increase women participation in all social, political and economic decision making processes as well as increasing all-round opportunities for women. In order to achieve these aims, the plan intends to begin by raising women representation in the National Assembly, improving access to services such as education, health, housing and justice. All these factors will positively enhance gender equity in education development in the country through minimizing the aforementioned vulnerabilities by prohibition of damaging cultural practices such as Female Genital Mutilation, raising enrollment for girls especially those from nomadic communities as well as slum and poor rural communities, and achieving gender parity and impartiality in the delivery of justice.

Vision 2030 flagship projects

The country's strategic plan has various flagship projects which are to be implemented during the initial five years of the plan covering the years 2008 to 2012. A couple of these projects in Vision 2030 are designed to address gender equity concerns through promoting women's rights. One of these flagship projects is the supporting of the Women's Enterprise Fund which seeks to empower Kenyan women through creating opportunities for them on the economic front hence in turn benefiting the social and political empowerment of the female gender. The fund's inception in 2007 was followed by a budget allocation of Kshs. 1 billion in the same year indicating the government's commitment to addressing gender issues as well as women empowerment. The money from the Women Enterprise Fund is distributed through two channels namely, the Constituency Women Enterprise Scheme (C-WES) and selected financial intermediaries such as microfinance institutions such as the Kenya Women's Finance Trust (SID, 2010). The fund's administration is the responsibility of the Ministry of Gender, Children and Social Development and even though current data indicates that the demand for credit greatly

outweighs funds made available by the treasury, there are several strategies that the Government of Kenya is looking into so as to find ways to scale up the fund in order for it to have a significant impact on the empowering of women as well as to address gender inequity in the country.

The second flagship project to be implemented in line with Kenya's Vision 2030 is the establishment of the Social Protection Fund under the plan's social pillar whose objective is to offer support to the vulnerable and poor women in Kenya. The fund is to be established by 2012 and is sure to tremendously steer the nation towards achieving gender equity in education development as it recognizes the significance of the economic empowerment of women in order to promote equal participation with men. The Social Protection Fund is intended to enhance the facilitation of easy access to credit as well as cash transfers on flexible terms and this clearly aims at promoting the establishment of small scale businesses for women. Through the SPF, the government will address women's needs and hence the fund's establishment provides the needed basis for the attainment of the goals in Vision 2030.

The Youth Enterprise Fund is another flagship project of vision 2030 that also resonates with the two other aforementioned projects in the implementation of various initiatives that seek to address gender equity concerns in Kenya. The fund greatly empowers women through ensuring equal access to credit facilities which in turn significantly benefits young Kenyan women since they are now able to establish successful businesses which, apart from creating an opportunity for them to earn incomes essential to improving their lives, also create the opportunity for them to create employment opportunities for other women. The fund which falls under the administrative structure of the Ministry of Youth and Sports has also been focused on meeting gender equity goals through having its initiatives being advanced more towards young women than men and as statistics presented by the Kenya Gender Data Sheet in 2008 indicated, more young women had received funds for the purpose of business establishment than young men (ADFVI, 2008).

Higher education reforms

Several reforms in higher education in the country have also helped in steering the country towards attaining gender equity in education development. One such initiative is the adoption of affirmative action as a policy by the Ministry of Higher Education Science and Technology which aims to offer more opportunities for women in higher learning institutions during admission (Onsare, 2011). The ministry intends to implement the policy so as to be in line with the new Kenyan Constitution by enhancing provision for higher education qualifications to women who will eventually form at least thirty per cent of public appointments and positions as well as holding positions in at least thirty per cent of all industry sectors.

Higher education institutions have also set out strategies that address gender equity in education development. Many public universities have set out periodic strategic plans that have included and addressed gender equity importantly and these plans have included setting up outreach strategies to involve stakeholders such as women groups in their local communities. For example, Jomo Kenyatta University of Agriculture and Technology has established a directorate of gender which aims at enhancing gender equity in research and training while also being tasked at enhancing gender equity throughout the institutions through various means such as empowering women by training those in rural areas in basic entrepreneurship skills as well as agriculture.

Gender equity in other countries

Throughout the world, promotion of gender equity has become widely accepted as an essential requirement for attaining development in terms of economic growth as well as in other sectors. The great number of global initiatives including global treaties which focus especially on achieving gender equality and the empowerment of women are testament of this commitment. Looking at a few countries that have made good progress in the journey to achieving gender equity, we note that Kenya is on the right path since the country is also a signatory to the many international and regional treaties in support of achieving gender equity in all sectors including education development. For example, Argentina has accomplished a lot in the quest to achieving gender equity as its well known globally. Despite various impediments such as traditional Catholic influence which is a big driver of the "macho" culture, the country's widely known history of having female leaders has had a great impact on the progression of gender equity. Initiatives such as the adoption of a quota law for the participation of women in the country's Congress as well as a significant rise in the female representation in the National Legislature which was at 33.7 per cent in 2005 from a low of 4.3 per cent in 1983 signifies this progress. Illiteracy levels among the country's women also stands equal to that of the men at 3.1 per cent which shows how much gender disparity has been quelled and hence it's not shocking that the country is ranked fifteenth in the world for female participation in national legislation (Foundation for Sustainable Development, 2011).

African nations are also determined to achieve gender equity due to the aspect's significance towards attaining development targets. South Africa was among the pioneers in setting out to achieve gender equity through various notable initiatives such as the innovative Women's Budget Initiative (WBI) that was set up in 1995. This initiative intends to impact on the resource allocation mechanisms by ensuring impartial benefits between the genders. It does this by tracking down the impact of country's budget on women. This budget is developed from a gender perspective view. Similarly, Rwanda is tremendously ahead among all other countries within the Eastern African region in the promotion of gender equity in all areas especially education development. Comparing the country's female gross enrollment ratios (GER) to those of the whole of Sub-Saharan Africa as indicated in the United Nations Millennium Development Goals Report of 2005, Rwanda's GER was at 102 as compared to the region's 86 for primary school enrollment, while the secondary schools GER was at 93 compared to Sub-Saharan Africa's 79. This can greatly be attributed to the country's environment policy that has improved both the access to education as well as massively improving gender parity in all education levels (Ojiambo, 2009).

Conclusion

In summary, although Kenya can be said to be significantly ahead in terms of attaining gender equity in education development in comparison to many other Sub Saharan African countries, the facts and statistics still indicate that the Kenyan women form a minority of the country's decision making mechanism in all areas including the management of the country's education system and that gender disparity continues to restrain the achievement of gender equity particularly in education development even with the enhanced accessibility since that only forms one part of educational opportunities. But the country's new constitution as well as newly enacted policies and legislations which have already been successful in strategizing gender equity in all sectors including education development are encouraging. Kenya therefore looks forward to implementing her policies and making sure that the success she has made is maintained in order to achieve middle income status by vision 2030.

Endnotes

[1] Chuei Mareng, *Development of women's education in Kenya*. (Academic Journals, 2010)
[2] S. Anyangu-Amu, *Rapid population growth threatens development*. (http://ipsnews.net, 2010)
[3] G. Wokocha, *Religious and cultural issues in gender equity: Implications for science education*. (Journal for educational research, 2009)

1. [4] Chris Wosyanju, 2009:9 *The system of education in Kenya*.

[5] Government of Kenya, *Kenya Vision 2030: The Popular Version*. (Nairobi: National Economic and Social Council, 2007)
[6] Government of Kenya, *Kenya Vision 2030: The Popular Version*. (Nairobi: NESC, 2007)

References

African Development Forum VI (2008). *Achieving gender equality and women's empowerment in Africa: Progress Report*.

Anyangu-Amu, S. (2010). *Rapid population growth threatens development*. Retrieved on 26th July 2011 from http://ipsnews.net/africa/nota.asp?idnews=50664

Cheserek, E. (2011) *Moi University plan to boost female students' enrolment*. Retrieved on 26th July 2011 from http://www.standardmedia.co.ke/education/InsidePage.php?id=2000032625&cid=316&

FIDA Kenya. (2010). *Gains for Kenyan women in the Constitution*. Retrieved on 26th July 2011 from http://fidakenya.org/2010/10/gains-for-kenyan-women-in-the-constitution/

Foundation for Sustainable Development, (2011). *Gender equity issues in Argentina*. Retrieved on 27th July 2011 from http://fsdinternational.org/country/argentina.

Government of the Republic of Kenya (2007). *Kenya Vision 2030: The Popular Version*. Nairobi: National Economic and Social Council of Kenya(NESC).

Kariuki, J. (2011). *Gender issues in the New Constitution of Kenya*. Retrieved on 27th July 2011 from http://jessekariuki.blogspot.com/2011/02/gender-issues-in-new-constitution-of.html

Kisilu Kombo and Kimani, E (2010). *Gender and poverty reduction: A Kenyan context.* In: *Educational Research and Reviews*, Vol. 5 No. 1.

Mareng', C (2010). *Development of women's education in Kenya*. In: International NGO Journal. Vol. 5, No. 3.

Ojiambo, P. (2009). *Quality of education and its role in national development: A case study of Kenya's educational reforms*. In: *Kenya Studies Review*. Vol. 1, No1.

Onsare, R. (2011) *Kenya: Affirmative action for women on the agenda at higher education conference*. Retrieved on 26th July 2011 from http://theglobalherald.com/kenya-affirmative-action-for-women-on-the-agenda-at-higher-education-conference/22245/

Oparanya, W. (2010). *Secondary school sector as a component towards the realization of Kenya Vision 2030*. Retrieved on 26th July 2011 from http://www.planning.go.ke/index.php?option=com_content&view=article&id=265:secondary-school-sector-as-a-component-towards-the-realization-of-kenya-vision-2030&catid=53:minister&Itemid=93

Palsule, M. (2009). *Religion vs. gender equality and feminism.* Retrieved on 26th July 2011 from http://skeptic.skepticgeek.com/2009/06/24/religion-vs-gender-equality-feminism/

Society for international development. (2010). *Kenya's Vision 2030: An audit from an income and gender inequalities perspective*. Nairobi: SID.

Tania Boler and Aikman, S (2008). *Gender equality, HIV, and AIDS: A challenge for the education sector*. Oxford: Oxfam GB.

Wosyanju, C. (2009). *The system of education in Kenya*. Retrieved on 26th July 2011 from http://international.iupui.edu/kenya/resources/Education-in-Kenya.pdf

Wokocha, G. (2009). *Religious and cultural issues in gender equity: Implications for science education*. In: *Journal for educational research* Vol. 8 No 1 &2.

Effect of Nanoclay on the Curing and Thermal Conductivity of Unsaturated Polyester Resin

Lawrence V. Madriaga
School of Chemical Engineering and Chemistry
Mapua Institute of Technology
Intramuros, Manila, Philippines

Abstract *-- This study was aimed at understanding effect of nanoclay on the heat transfer mechanism in a nanoclay-filled amorphous polymer-matrix composite. Nanocomposites of 1 to 15% by volume filler content were fabricated using the solution intercalation method. Dispersion of the nanoclay was done via ultrasonication. Differential Scanning Calorimetry (DSC) scans were done on the pristine polymer and those combined with nanoclay using both isothermal and dynamic modes of heating to determine the curing kinetics. Thermal conductivity measurements were performed at 50°C, 75°C, and 100°C, with the data fitted into existing mathematical models to define the conduction mechanism that could have transpired in the material. Thermal conductivity of the nanocomposites increased from 1.24±0.07 W/mK to 7.40±0.07 W/mK at 50°C with increasing nanoclay content with an apparent percolation threshold at 13% filler content. Fitting the experimental data with existing models for thermal conduction in composites revealed that the best fit is that with the Hasselman and Johnson model. Using this model, the effective thermal conductivity of the nanoclay was calculated to be around 15.78 W/m which is within the theoretical range of values of the bulk thermal conductivities of the nanoclay component compounds. Fitting the measured thermal conductivities to the scaling law revealed that the percolation threshold is around 12.49% filler content. Results from the DSC scans revealed that the extent of cross-linking generally decreases with increasing nanoclay content. Given the above considerations, it can therefore be said that the mechanism of conduction in the composite material involved the improved conduction in the matrix that is in series with the conduction along the nanoclay fillers, which have higher conductivities at their nanometer dimensions.*

Keywords: *Unsaturated Polyester, MMT, Cure Kinetics, Thermal Conductivity, Percolation*

I. INTRODUCTION

Nanocomposites with matrix based on organic polymers and Montmorillionite (MMT) filler have attracted great attention due to interesting properties such as reduced gas permeability [12], improved solvent resistance, superior mechanical [13] and enhanced flame-retardant properties [11] that have potential applications in automobile,

construction, electronics and electrical, food packaging, and

aviation industries [1]. MMT is naturally occurring nanoclay with considerable deposits throughout the Philippines. MMT is conventionally called nanoclay because it is made up of layers of magnesium and aluminum silicate platelets, which are 1 nm thick and several tens to several hundreds of nanometers across [6].

An area where MMT-based nanocomposites have not been fully explored is in heat transfer applications. In the semiconductor industry, Thermal Interface Materials (TIM) are polymer composites used to enhance the heat transfer between a silicon die and the heat sink in a microelectronic device. Most commercial TIMs use silicone rubber as matrix and an array of particles as fillers, i.e. silver particles and alumina particles. These particles as well as silicone rubber are relatively expensive and difficult to process. Thus, the idea of fabricating a TIM from less expensive and more readily available materials is an attractive proposition.

Unsaturated Polyester (UP) is one of the most widely used polymer matrix, especially for structural composites, due to its relatively low cost, ease of processing, and commercial availability. When fully cured, UP has an amorphous structure. It has not been used for heat transfer applications because of its low thermal conductivity brought about by its amorphous structure which promotes phonon scattering.

II. Objectives

The aim of this study is to understand the heat transfer mechanism in a nanocomposite composed of an amorphous polymer (UP) matrix and MMT filler for the purpose of considering UP-MMT nanocomposite as a TIM. Specifically, the objective of this study is to determine the effect of MMT on the structure and thermal conductivity of UP.

III. Methodology

Nanocomposites of UP and MMT (1%-15% by weight) were prepared using Solution Intercalation. The MMT used was the commercially available, organically modified type (Cloisite 20A, average platelet thickness of 1nm). Cross-linking was induced by the addition of Methyl Ethyl Ketone Peroxide (MEKP) catalyst. To fully describe the cure kinetics of UP and UP-MMT nanocomposite, isothermal (40 minutes at 90°C) as well as dynamic (10°C/min, 15°C/min, and 20°C/min) DSC scans were performed immediately after the addition of MEKP. Thermal conductivity measurements were done on 5mm thick circular samples cured for 7 days at room temperature. Data from cure kinetics were fitted into accepted kinetic models using the Levenberg-Marquardt (LM) method. Measured thermal conductivity values were also fitted into existing mathematical models for thermal conduction in composites also using the LM method.

IV. Results and Discussion

Isothermal DSC scans were done to initially assess the effect of MMT on the extent of curing of UP.

Fig. 1 shows a decrease in the heat flow with the addition of nanoclay relative to the pure unsaturated polyester matrix. Cross-linking is generally exothermic, thus less exothermic heat flow could be interpreted as decrease in the extent of curing. For the pristine UP, the heat flow is exothermic until around 1300 seconds. This could mean that curing was completed at around that time at

90°C. For the case of the nanocomposites, exothermic heat flow stopped at around 600 seconds for 3% and 5% filler loading, and around 1100 seconds for the 13% filler loading. The absence of exothermic heat flow means that curing has ceased for the nanocomposite sample. The relatively higher heat flow for the 13% filler content could mean increase in the extent of cross-linking relative to the lower filler content composites, but this has to be verified by dynamic DSC scans. Another possible reason for the increased heat flow for the 13% filler content sample could be the relatively large amount of nanoclay in relation to the amount of polymer. The total exothermic heat flow was calculated from the area under the curve using the Origin Pro™ software. The values are 26.37 J/g for UP, 9.44 J/g for 3% filler content, 2.85 J/g for 5% filler content, and 24.09 J/g for 13% filler content.

Fig. 2 show that in general, there are three peaks for each dynamic scan for the neat resin and the nanocomposites, specifically those containing 3% and 5% nanoclay. For these three samples, the first peak is attributed to the decomposition of MEKP during initiation reaction [5]. The two subsequent peaks correspond to the two reactions happening after initiation which are cross-linking (1st peak) and homopolymerization of polyester molecules and styrene molecules (2nd peak) [7]. Unlike the two other nanocomposite samples, the 13% filler content exhibited an endothermic peak. With this, a similar scan for nanoclay was performed to determine the possible cause of the peculiar behavior of the 13% filler content. Fig. 2 shows that the scan for both 13% filler content and the nanoclay were almost identical. Thus, the endothermic peak for the 13% filler content is attributed to the presence of a relatively large amount of nanoclay. The endothermic peak is attributed to the evaporation of water trapped within the nanoclay structure [4].

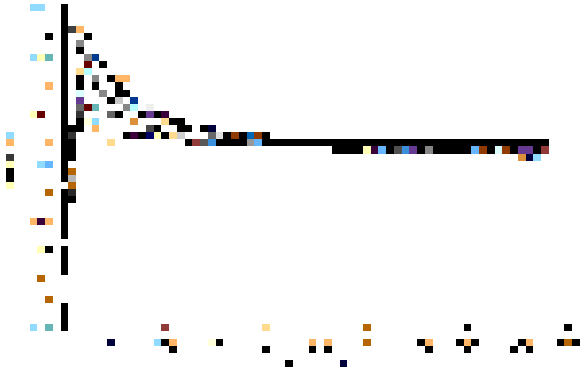


Figure 1. Isothermal DSC scans taken at 90°C for the matrix material, and uponaddition of 3, 5, and 13% by volume nanoclay.

Figure 2. Dynamic DSC scans at 10°C/min at varying nanoclay contents (Heat flow values were normalized to better reveal varying peak temperatures)

The dynamic scans also allow for the determination of the activation energies for the two reactions mentioned. A higher heating rate would result to a shift of the peak position of the reactions to a higher temperature. These different temperatures and corresponding heating rates were analyzed using the Kissinger equation.

 (1)

This equation allows the calculation of the activation energy (E_a)of a reaction (i.e. curing) from the plotted values of heating rate (β) and the corresponding maximum temperature (T_p) of the exothermic DSC peak of that reaction. *A* is a pre-exponential constant and *R* is the gas constant. Fig. 3 shows a comparison of the average calculated values of the $E_a$for the neat resin and the nanocomposites with different filler loadings. The calculatedE_a and *A*for the neat resin were used to calculate for the reaction rate constants (*k)* for the cross-linking and homopolymerization reactions using the equation shown below.

 (2)

The DSC scans allowed for the calculation of the extent of cure of UP and the UP-MMT nanocomposite samples. Fig. 4 shows that the extent of cure for unsaturated polyester increases with time and reached full curing at around 1280 seconds (≈21 minutes) at 90°C isotherm. The same method was used to calculate for the extent of cure of 3%, and 5% by volume MMT nanocomposites. For the same length of time as that of the pure polymer (1278 seconds), the extent of cure was calculated to be 25% and 10.3% for the 3% and 5% filler content samples, respectively. These values mean that while the pure polymer is fully cured after about 20 minutes at 90°C, the extent of curing for the nanocomposites is only around 26% or less under the same conditions and the same length of time. This can be used to explain why physical inspection of the nanocomposites revealed that they are less rigid (softer) than the pure polymer samples.

Having calculated the reaction rate constants, k_1 and k_2, the values of the order of reactions, *m* and *n* can then be calculated. The values of k_1 and k_2 at 27°C (300 K) were calculated at 0.0792 (s^{-1}) and 0.0053 (s^{-1}), respectively. These were substituted in the Kamal Model to come up with:

$$\frac{d\propto}{dt} = [0.0792 + 0.0053 \propto^m][1-\propto]^n \quad (3)$$

The calculated values of *d*α/dt and α for the pure polymer were fitted into the equation above to determine values of *m* and *n*. Data fitting was done using the Levenberg-Marquardt (LM) method of non-linear curve fit. The initial estimates for the values of *m* and *n* were determined from initial fitting using MS Excel. After employing the method described above, the values were determined to be *m*=2.14 and *n*=1.47. With these, the equation now becomes:

$$\frac{\mathrm{d}\propto}{\mathrm{dt}} = [0.0792 + 0.0053 \propto^{2.14}][1-\propto]^{1.47} \quad (4)$$

This equation represents the rate of cure of unsaturated polyester as a function of temperature and further suggests that the cross-linking reaction is more of a 2nd order reaction while the homopolymerization reaction is more of a first order reaction.

The results of DSC experiment suggested that there is a decrease in the extent of cross-linking with the addition of nanoclay. There could be several reasons for this and two of them could be intercalation [4] and/or inhibition of cross-linking by the organic component of the nanoclay [5].

It has been established that the extent of cross-linking of unsaturated polyester is decreased in the presence of nanoclay. This could lead to an increase in thermal conductivity of the UP-MMT nanocomposites in relation to that of the neat resin. In a study by Hansen, et al. [14], they concluded that for similar types of polymers that has linear and branched (or cross-linked form); the linear configuration will have the higher thermal conductivity. This projected increase in the

thermal conductivity as a result of lesser extent of cross-linking in the presence of nanoclay was validated by the thermal conductivity measurements on the nanocomposites shown in Fig. 5.

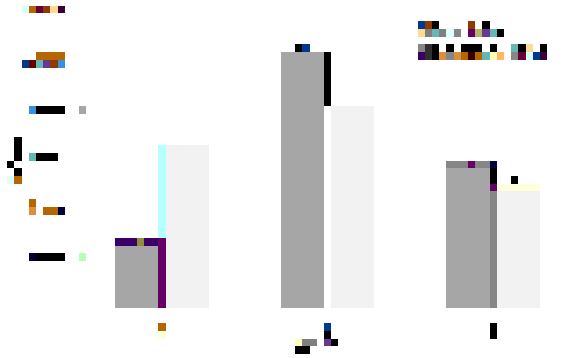


Figure 3. Relative change in calculated activation energy with varying nanoclay content

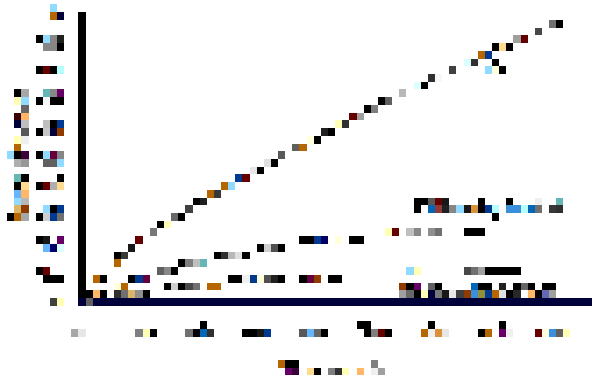


Figure 4. Plot of calculated extent of cure versus time for UP, 3% nanoclay content, and 5% nanoclay content

Figure 5. Thermal Conductivity of the nanocomposites as a function of MMT content at different temperatures.

Measurement of the thermal conductivity of UP-MMT nanocomposites paved the way for the estimation of the non-bulk thermal conductivity of nanoclay. The bulk conductivity of nanoclay was measured to be at 3.6 W/mK using a pelletized form of the nanoclay subjected to the thermal conductivity apparatus. This value, however, combined with that of the unsaturated polyester at 1 W/mK could not explain the measured thermal conductivity of the nanocomposites that were as high as 9 W/mK because typically, properties of composites can only be between those of the matrix and the filler. This suggests that the effective thermal conductivity of the nanoclay should be much higher than the measured bulk conductivity. The effective thermal conductivity of the nanoclay filler was calculated from the experimental data using existing mathematical models. The LM Method was employed to fit to the different models and determine the values of unknown variables.

Fitting the experimental data with the Maxwell's and Rayleigh's models show poor fit as shown in Fig. 6.The experimental data was also fitted into the Hasselman and Johnson model for plate-like fillers. The fitting gave a value for the nanoclay thermal conductivity of 15.78 W/mK with R^2 value of

0.92. Additionally, the factor ah_c representing heat transfer at the interface of matrix and the filler was calculated to be 0.41 W/mK.

A sharp increase in the thermal conductivity at 13% filler loading can be observed after a steady, almost linear increase of the same property from 1% to 11% filler content (see Fig.5). This suggest that at 13% filler content, thermal transfer in the composite is apparently optimized and is speculated to be induced by the optimization of filler distribution and configuration leading to the formation of a continuous conducting path, which happen to be technically defined as the percolation threshold. From earlier discussions, intercalation led to less cross-linking in UP and therefore the structure became more linear. This more linear structure increased the thermal conductivity of the UP matrix since linear polymers have higher thermal conductivity than their cross-linked counterparts. If and when the intercalated structure of the nanoclay with the linear UP molecule in its intergalleries and the agglomerates form a link with each other at a certain temperature, then a continuous conducting path is created, leading to percolation as shown in Fig. 8.

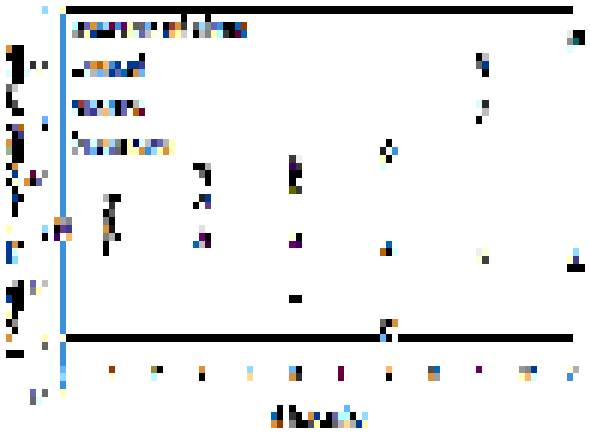


Figure 6. Comparing the thermal conductivities calculated using the different models to the experimental values.

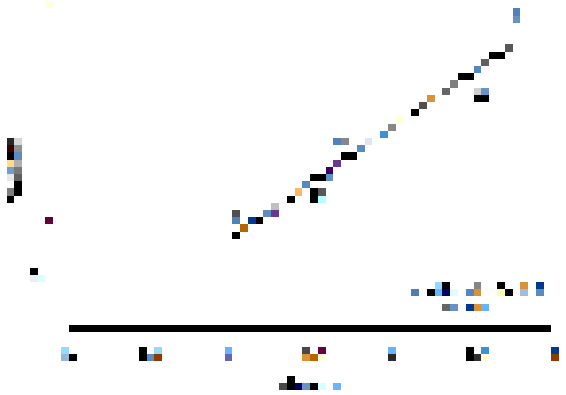


Figure 7. Calculated values for thermal conductivity at k_f=15.78 W/mK compared with experimental values measured at 50°C.

Figure 8. Illustrating the formation of a continuous conducting path by the interconnection of high thermal conductivity intercalated nanoclay platelets and nanoclay agglomerates.

In order to fully describe the percolative behavior of the UP-MMT nanocomposites with respect to thermal conductivity, it was necessary to fit the experimental thermal

conductivity data in the scaling equationas described by Mandal, et al [10]. Data fitting was done using the non-linear fitting method previously used in this study. The values were determined to be: C=0.33, f_p=0.1249 and t=0.07. The equation describing percolation in thermal conduction for the UP-MMT nanocomposites thus becomes:

$$k = 0.33(f\text{-}0.1249)^{0.07} \quad (5)$$

In summary, thermal conductivity of the nanocomposites can be described by the Hasselman and Johnson model at low filler loadings, i.e. <9% by volume, while it can be described by the percolation theory at higher filler loadings, i.e. between 9% and 15% by volume.

V. CONCLUSIONS

This study found that nanoclay increases the thermal conductivity of unsaturated polyester due to the following reasons: (1) Nanoclay has a much higher thermal conductivity than unsaturated polyester, thus mixing the two would result to a higher thermal conductivity for the mixture; (2) Intercalation of polymer chains into the nanoclay galleries led to lower cross-linking density, making the polymer more linear in structure resulting to a higher thermal conductivity. Given the above considerations, it can therefore be said that the mechanism of conduction in the composite material involved the improved conduction in the matrix that is in series with the conduction along the nanoclay fillers, which have higher conductivities at their nanometer dimensions.

REFERENCES

[1] Basilia, B.A. (2004). *Hybrid formation and properties of polymer layered silicate nanocomposites.* College of Engineering, University of the Philippines, Diliman, Quezon City, Philippines, 8-54.

[2] D. Chen and P. He. *Monitoring the curing process of epoxy resin nanocomposites based on organo-montmorillonite – a new application of resin curemeter.* Elsevier, 2004

[3] D.J. Suh. *The property and formation mechanism of unsaturated polyester–layered silicate nanocomposite depending on the fabrication methods.* Elsevier, 2000

[4] E.G.D. Tabares, I.A.C. Razonado, L.V. Madriaga, L.J.L. Diaz. *Morphology and compressive property of UP-MMT nanocomposites.* Proceedings of the PICHE National Convention, 2011.

[5] Jacobs P.M. and Jones F.R., *"The influence of heterogeneous crosslink density on the thermomechanical and hygrothermal properties of an unsaturated polyester resin: 1. Thermomechanical response*", Polymer, vol.33, no.7, 1418-1422, 1992.

[6] L. Torre, E. Frulloni, J.M.Kenny, C. Manferti, G. Camino, J. Appl. Polym. Sci. 90 (2003) 2532.

[7] L. Xu. *Effect of nanoclay on shrinkage control of low profile unsaturated polyester (UP) resin cured at room temperature.* Elsevier, 2004.

[8] L.V. Madriaga. *Synthesis and characterization of polymer-clay nanocomposite for suitability as thermal exchange material.*

Proceedings of the 2nd ERDT Conference (2009)

[9] Lagaly, G. (1981). *Characterization of clays by organic compounds.* Clay Minerals. **16**, 1-21.

[10] Mandal, B. M.*Conducting polymer nanocomposites with extremely low percolation threshold.* Bulletin of Materials Science, pp. 161-165.

[11] Xiong J. *Composites.* **38,** 132-137 (2007)

[12] Y. Mai, Z. Yu, (2006). Y. Mai, Z. Yu. ed. *Polymer nanocomposites*. Woodhead Publ. ISBN978-1-85573-969-7.

[13] Zhou, Y., Pervin, F., Rangari, V.K., and Jeelani S. (2007). *Influence of montmorillonite clay on the thermal and mechanical properties of conventional carbon fiber reinforced composites.* Journal of Materials Processing Technology. **191**, 347-351.

[14] D. Hansen. *Thermal conductivity of polymers.*P.E. Slade and L.T. Jenkins, New York, USA

[15] G. Youngblood. *The transverse thermal conductivity of 2D-SiC/SiC composites.* Journal of Nuclear Materials. 2000

Synthesis, structural characterization of Co(II), Ni(II) and Cu(II) complexes of azo dye ligands derived from dihydroxynaphthalene

Dilek ÇANAKÇI[a,*] Oğuz Yunus SARIBIYIK[b], Selahattin SERİN[c]

aDepartment of Chemistry, Technical Faculty, Adıyaman University,02040, Adıyaman, Turkey
bDepartment of Bio Engineering, Engineering Faculty, Gümüşhane University,29100, Gümüşhane, Turkey
cDepartment of Chemistry, Faculty of Science and Arts, Çukurova University,01330, Adana, Turkey

Abstract

Some new azo compounds were prepared by coupling the diazonium salts of amines and 2,7-dihydroxynaphthalene and 1,6-dihydroxynaphthalene. The structure of azo compaunds were determined on the basis of elemental analyses, UV–vis, IR, ^{1}H-NMR spectra and also by aid of scannicing electron microscopy (SEM). Complexes of cobalt(II), nickel(II), copper(II) with a heterocyclic azo derivatives heve been synthesized and characterized. The composition of complexes have been established by analytical (elemental analysis and magnetic susceptibility measurements) and spectral(UV–vis, IR) methods. Analytical data revealed that all the complexes exhibited 1:2 metal–ligand ratio. On the basis of magnetic susceptibility measurements, suitable geometry was proposed for each complex. IR spectra of complexes show that the ligands are coordinated to the metal ions in bidentate manner with ON donor sites of hydroxynaphthalene OH and azo N.

Keywords: Azo dyes; Metal complexes; Dihidroxynaphthalene; NMR; Copper; Cobalt.

1.Introductıon

Azo compounds are the oldest and largest class of industrial synthesized organic dyes due to their versatile application in various fields, such as dyeing textile fiber, biomedical studies, advanced application in organic synthesis and high technology areas such as laser, liquid crystalline displays, electro-optical devices and ink-jet printers [1–3].Azo dyes which consist of at least a conjugated azo (–N=N–) chromophore [4,5] Many azo-compounds have been applied as chromogenic reagents for the determination of several metal ions [4,5] The use of such reagents was found to depend essentially on their UV–vis spectral properties. Many articles have been published concerning the spectral characteristics of azocompounds [6–8], which dealt with spectral-structure correlations as well as the effects of the medium on the band position. However, it seems that no studies were carried out concerning azo-compounds based on dihydroxynaphthalenes.

The coordination complexes of transition metals with azo-ligands are of current attraction due to the interesting physical, chemical, photophysical and photochemical, catalytic and different material properties. The p-acidity and metal binding ability of azo nitrogen have drawn attention to the exploration of the chemistry of metal complexes incorporating azo-ligands [9–16]. The coordination chemistry of transition metals with azo ligands is being studied due to the observation of several interesting properties. Facile metal–carbon bond formation and the subsequent reactions of some

orthometallated azobenzene and related molecules demonstrated their importance in C–H bond activation [17,18,19].

2.Experimental

2.1. Materials and methods

All the chemicals used were of Analytical grade. Melting points reported were determined by open capillarymethod. Carbon, hydrogen and nitrogen analyses were performed using Elementar Analysensysteme GmbH-vario MICRO Element Analyzer. The electronic spectra of the complexes were recorded on a Shimadzu 2101 UV–vis spectrophotometer. Infrared spectral studies were carried out using KBr discs on a Perkin Elmer FT-IR spectrophotometer. Proton and carbon NMR spectra of the ligands were recorded on a Bruker AC 400MHz FT-NMR spectrometer employing TMS as internal reference and DMSO-d6 as solvent. The morphologies of the azo dyes were examined by Leo 440 Computer Controller Digital Scanning Electron Microscopy (SEM). Cu, Co and Ni were determined by atomic absorption spectroscopy using Hitachi Atomic Absorbtion Spektrofotometre (AAS). Room temperature magnetic susceptibility measurements were carried out on powdered samples using a Sherwood Scientific MX1 Model Gouy Magnetic Susceptibility Balance.

2.2.Synthesis of azo ligand

All azo compounds were prepared in similar manner [20]. A cold solution of phenyldiazonium salt [14.9 mmol] was prepared by adding a solution of $NaNO_2$ [14.9 mmol into 12 mL H2O] to a cold solution of aromatik amines hydrochloride [14.9 mmol of aromatik amines: 2-chloro-4-nitroaniline, 2,5-dichloroaniline, 2-nitroaniline, 4-nitroaniline 4-chloroaniline and p-anilinesulfonic asit in 35 mL conc. HCI]. The resulting solution of diazonium salts were added dropwise to the corresponding naphthol: 1,6 and 2,7-dihydroxynaphthalene at 0 ^{o}C. The reaction mixture was stirred for 1 h at the same temperature and the precipitate was filtered off and organic impurities were then extracted by washing with small portions of diethyl ether. The precipitated azo dyes were dried under vacuum at 70 ^{o}C [Fig.1]. The purity of the compounds was tested by constancy of melting points and the data of the C, H and N elemental analysis [Table 1]

2.3.Synthesis of metal complexes

All of the complexes were synthesized by adding of the appropriate metal salts [2.0 mmol, in 20 ml ethyl alcohol–water (1:1)]to a hot solution of the ligands [2.0 mmol, in 30 ml ethyl alcohol (95%)]. The pH was adjusted to 6.00–7.00 using alcoholic sodium hydroxide [0.01 M]. The resulting solutions were stirred and heated on a hot plate at 75 ^{o}C for 4 h. One day later, the colored solid of the complexes formed was filtered, the solids washed with ethanol and diethyl ether, and finally dried under vacuum[Fig.2]. The synthesized complexes were recrystallized from ethanol–water (1:1). The purity of the metal complexes was tested by constancy of melting points and the data of the C, H and N elemental analysis [Table 1]. All complexes were prepared by the same method and isolated as powdered material. Elemental analysis, IR, UV–vis, Magnetic Susceptibility as well as atomic absorption spectra confirmed the composition of metal complexes.

3.Results and discussion

3.1.Infrared [IR] spectra of azo dyes

The infrared spectra of all azo compounds under study display a strong broad band at 3522-3140 cm^{-1} [Table 2] corresponding to the νOH of the naphthyl moiety [Fig.3] shows the IR spectrum of L_1 as a representative example. The low value indicates that this OH group is involved in an intramolecular hydrogen bonding with the N=N group. For the azo compounds, a weak band or shoulder appears on the higher wave number side of this band, which corresponds to the νOH of the nonhydrogen bonded group. The two medium or weak bands within the 2925-2824 cm^{-1} range are assigned to the νCH vibrations of the aromatic rings. The weak intensity bands at 1643-1531 cm^{-1} corresponds to the νC=C stretching vibrations of the aromatic rings. The symmetric νN=N stretching mode leads to a medium band at 1504 cm^{-1}, while the νOH mode gives an intense broad band within the range 1226-1187 cm^{-1}. The in-plane deformation vibrations of the C-H bonds lead to sharp medium bands within the 1413-1119 cm^{-1} range. On the other hand, the out of plane C-H deformation gives strong band at 891-715 cm^{-1}. The NO_2 and Cl group modes of the L_1 ligand appear as weak band at 1531 cm^{-1} and sharp band at 741 cm^{-1}

3.2.UV-vis spectra of ligands

The electronic absorption spectra of the azo compounds under study were recorded in four organic solvents of different polarity, namely ethanol, methanol, DMF and DMSO. The spectra of the compounds in etanol [Table 3] display, in most cases, four bands. The first band at λmax = 210-250 nm can be assigned to the medium energy π-π* transition of the aromatic ring, while the second band at λmax = 250-290 nm is due to the low energy π-π* transition. The third band within the range λmax =320-340 nm is due to the π-π* excitation of the electrons of the azo groups. The last band in the visible range [λmax =360-500 nm] is assigned to an intramolecular charge-transfer absorption involving the whole molecule. The UV-vis spectra of L_1 measured in the four different organic solvents[Fig.3], reveal that the positions of the bands due to localized electronic excitation are only slightly influenced by the solvents while the CT band is red shifted with increasing solvent polarity indicating that increasing solvent polarity leads to a higher solvent stabilization of the excited state [Fig.4].The little blue shift observed in methanol relative to nonpolar solvents, can be explained by the decreased energy of the intramolecular hydrogen bonds on going from the ground to the excited state[21].

3.3.^{1}H-NMR spectra of azo dyes

The ^{1}H-NMR spectra of the azo-compounds under study display a group of signals corresponding to the hydrogens of each molecule, the position of which varies according to the molecular structure of the compound. In general, the compounds exhibit the following characteristics chemical shifts as shown in Table 4. As previously reported, the compounds shown in Figur 1 are present in solution as a proton transfer equilibrium. In all cases, their ^{1}H-NMR spectra showed a signal with a chemical shift in the range 17-11 ppm, corresponding to the O–H· · ·N proton involved in the relevant intramolecular hydrogen bond. The signal at higher field within the range 12-10 ppm for the azo-compounds is due to the free OH group. In ^{1}H-NMR spectras of L_1 and L_2, ıt is seen that the signal of OH group (2-H) Which do hydrogen bond is broader than the signal of free OH group (8-H). The

hydrogens of the naphthyl moiety display two groups of signals at 7.8-7.5 and 6.9-6.4 ppm characteristic for the two naphthyl rings. The hydrogens of the anilin ring are observed at 8.4–7.8 and 7.3 ppm. In the ^{1}H NMR spectrum of L_3 (Fig. 5), showes singlent signals of OH protons (2-H and 8-H) at 16.2 and 10 ppm. 3-H, 4-H, 6-H, 7-H and 9-H protons of naphthyl give a doublet ($J_{3,4}$ = 8.80 Hz, $J_{4,3}$=8.41 Hz, $J_{6,7}$ = 9.61 Hz, $J_{7,6}$ = 8.42 Hz). Also While 12-H and 15-H proton of aniline give a doublet signals ($J_{12,13}$ = 8.32 Hz, $J_{15,14}$ = 7.11 Hz). 13-H and 14-H protons are a triplet ($J_{13,12}$ = 8.35 Hz $J_{13,14}$ = 7.31 Hz, $J_{14,13}$ = 8.40 Hz $J_{14,15}$ = 8.40 Hz).

3.4.Scanning electron microscopy [SEM] of azo dyes

Morphology of the azo dyes obtained were studied by SEM. The obtained SEM micrographs, shown in Fig.6. Obtained results showed that azo dyes are highly microporous with a pore size of 1-5 μm. Also depending on the SEM micrographs it is found that pore structure and size were changed significantly depending on different substituends bonded aniline. When pore structures of azo dyes are compared with each other, ıt is seen that structures of L_1, L_3 and L_6 are more porous than L_2, L_4 and L_5.

3.5.UV-vis spectra of metal complexes

Magnetic moments and UV-vis spectra of the complexes are listed in Table 5. The absorption spectra of metal complexes shows four absorption bands in the UV and visible region. The first two bands observed at 211–248 and 258–288 nm undoubtedly originate from the perturbed local excitation of the phenyl group. The bands located at 296–329 and 488–378 nm corresponds to the $\pi\rightarrow\pi^*$ and $n\rightarrow\pi^*$ transitions of the azo group [22]. However, the spectra of complexes shows bathochromic shift in comparison with freeligands. According to the strong absorption of the complexes in a near ultraviolet region, the obvious bathochromic shifts for some of the metal (II)–azo complexes can not come from the forbidden d→d transition, which is generally too weak and in visible light or near infrared regions, but probably arises from the energy change of the intense $\pi\rightarrow\pi^*$ transition of the conjugated chromophore due to the chelation between metal (II) ions and azo ligands [23,24]. In addition, from Fig.7, it is clearly shown that the ability of metal ions to make red shifts was Ni(II) > Cu(II).

The results in our experiments can be explained as follows: after metal ion was connected with the oxygen atom of hydroxyl, the oxygen atom became easier to give unbonded electron to π electron system, which made red shift of absorption of azo ligand. This ability increases with the increasing of the positive electricity ability of metal ion. The positive electricity ability of metal ion is Ni(II) > Cu(II), so the difference of absorption maximum of metal (II)–azo complexes from metal (II)–azo complexes to their azo ligands is Ni(II)– azo > Cu(II)–azo. The electronic spectra of Co(II) complexes shows d–d transitions at 730-513 nm. The μ_{eff} value measured for the Co(II) complexes is in the range 4.54-3.98 μ_B, which is fairly close to those reported for the three unpaired electrons of Co(II) ion in an octahedral environment [25]. Most of Ni(II) complexes don't show d–d transitions. The room temperature magnetic moment values of Ni(II) complexes are 2.89-2.27 μ_B which is in normal range observed for tetrahedral Ni(II) complexes. The electronic spectra of Cu(II) complexes shows d–d transitions at 526-503 nm. The tetrahedral geometry of Cu(II) ion in all complexes is confirmed by the measured magnetic moment values in the 2.21-1.88 μ_B range.

3.6.IR spectra of metal complexes

The characteristic IR absorption bands of metal complexes were determined in KBr disk. Table 2 shows typical characteristic IR absorption bands. Infrared spectra of the complexes are very similar and they exhibit many sharp and strong vibrations within 1600-400 cm^{-1}[Fig.8]. However, the infrared

spectra of all the ligands exhibit bands around 1504-1500 $cm^{-1}$and 1342-1304 cm^{-1}corresponding to azo ν(-N=N-) and phenolic ν(C-O) stretching frequencies respectively. On complexation ν (-N=N-) appears at lower frequency in the range 1504–1471 cm^{-1} and this red shift supports the coordination of azo nitrogen to metal ion. The band corresponding to naphtolic ν(C-O) stretchingis shifted to lover frequency in the range 1332–1305 cm^{-1} in all the complexes confirming that the other coordination site is the naphtolic oxygen. This was further supported by the shifting of νOH band in the range 3678–3345 cm^{-1} in all the complexes. In addition, The νOH bands of complexes are broad than the νOH of ligand bands. A medium bands due to the ν(C=C) stretching vibration of aromatic rings appeared at 1649–1528 cm^{-1} in the free ligands. These bands are shifted to 1630–1516 cm^{-1} in the spectra of the metal complexes. The confirmation for the complexe is shown by extra bands in the IR spectrum of the complexes in the 668-465 cm^{-1} regions. The appearance of bands in the complexes in the 660-620 and 597-457 cm^{-1} regions which may be assigned to the ν(M-O) and ν(M-N) stretching vibrations of the coordinated O and N atoms of the ligands, respectively.

4.Conclusion

The desing and synthesis of a new dihydroxy azo dyes from 2,7- dihidroxynapththalene and 1,6-dihidroxynapththalene have been demonstrated. Suggested structures of the azo dyes are given in figür 1. Azo dyes metal complexes were sythesized in the next stage of the study. Azo dyes and ıts metal complexes were characterized by IR, UV–Vis, and ^{1}H-NMR spectroscopies and elemental analyses. The elementel analyses of azo dyes and ıts metal complexes gave satisfactory results corresponding to ligand:metal ration of 2:1for complexes. IR spectra of complexes indicate that azo compound coordinate to metal ions through the hydroxyl group and the azo nitrogen.

Acknowledgments

This work was supported financially by the Research Fund of Çukurova University under FEF2007D16. The authors wish to thank the Çukurova University for their support.

References

[1] S.C. Catino, E. Farris, Concise Encyclopedia of Chemical Technology, John Wiley & Sons, New York, 1985.
[2] K. Venkataraman, The Chemistry of Synthetic Dyes, Academic Press, New York and London, 1970 (Chapter VI).
[3] R. Egli, in: A.P. Peter, H.S. Freeman (Eds.), Colour Chemistry: The Design and Synthesis of Organic Dyes and Pigments, Elsevier, London, 1991 (Chapter VII).
[4] R. Kilincarslan, E. Erdem, Trans. Met. Chem. 32 (2007) 102–106.
[5] N. Kabay, E. Erdem, R. Kilincarslan, E.Y. Sari, Trans. Met. Chem. 32 (2007) 1068–1072.
[6] A.S. Abd-El-Aziz, T.H. Afifi, Dyes Pigments 70 (2006) 8–17.
[7] H.R. Maradiya, V.S. Patel, J. Serb. Chem. Soc. 67 (1) (2002) 17–25.
[8] R.W. Sabnis, Sulfur Rep. 16 (1994) 1–17.
[9] W.Y. Wong, S.H. Cheung, S.M. Lee, S.Y. Leung, J. Org. Chem. 596 (2000) 36.
[10] L. Carlucci, G. Ciaxi, D.M. Proserpio, S. Rizzato, New J. Chem. 27 (2003) 483.
[11] T. Akasaka, T. Mutai, J. Otsuki, K. Araki, J. Chem. Soc., Dalton Trans. (2003) 1537.
[12] F. Casalbani, Q.G. Mulazzani, C.D. Clark, M.Z. Hoffman, P.L. Orizondo, M.W. Perkovic, D.P. Rillema, Inorg. Chem. 93 (1998) 205.
[13] V.W.-W. Yan, V.C.-Y. Lan, K.-K. Cheung, J. Chem. Soc., Chem. Commun. (1995) 259.
[14] S. Frantz, J. Fiedler, I. Hartenbach, T. Schleid, W. Kaim, J. Organomet. Chem. 689 (2004) 3031.
[15] B.K. Ghosh, A. Chakravorty, Coord. Chem. Rev. 95 (1989) 239.
[16] B.K. Santra, G.A. Thakur, P. Ghosh, A. Pramanik, G.K. Lahiri, Inorg. Chem. 35(1996) 3050.
[17] (a) R. Acharyya, S.-M. Peng, G.-H. Lee, S. Bhattacharya, Inorg. Chem. 42 (2003) 7378;
(b) S. Nag, P. Gupta, R.J. Butcher, S. Bhattacharya, Inorg. Chem. 43 (2004) 4814;
(c) P. Gupta, R.J. Butcher, S. Bhattacharya, Inorg. Chem. 42 (2003) 5405;
(d) R. Aharyya, F. Basuli, R.Z. Wang, T.C. Mak, S. Bhattacharya, Inorg. Chem. 43 (2004) 704, and references therein.
[18] J. Pratihar, N. Maiti, P. Pattanayak, S. Chattopadhyay, Polyhedron 24 (2005) 1953.
[19] (a) S. Chattopadhyay, C. Sinha, A. Basu, A. Chakravorty, J.Organomet. Chem. 414 (1991) 421;
(b) S. Chattopadhyay, C. Sinha, A. Basu, A. Chakravorty, Organometallics 10 (1991) 1135, and references therein.
[20] M.S. Masoud, E.A. Khalil, A.R. Yousef, Synth. React. Inorg. Met.Org. Chem. 20 (1990) 793.
[21] G.C. Pimentel, J. Am. Chem. Soc. 79 (1957) 3323.
[22] P.P. Birnbaum, J.H. Linford, D.W.G. Style, Trans. Faraday Soc. 49 (1953) 735.
[23] H. Park, E.R. Kim, et al., Bull. Chem. Soc. Jpn. 75 (2002) 2067.
[24] S. Wang, S. Shen, Mater. Sci. Eng. B 79 (2001) 45.
[25] Z.H. Abd El-Waheb, Spectrochim. Acta A 67 (2007) 25.

Figure List

Figures

Figure 1

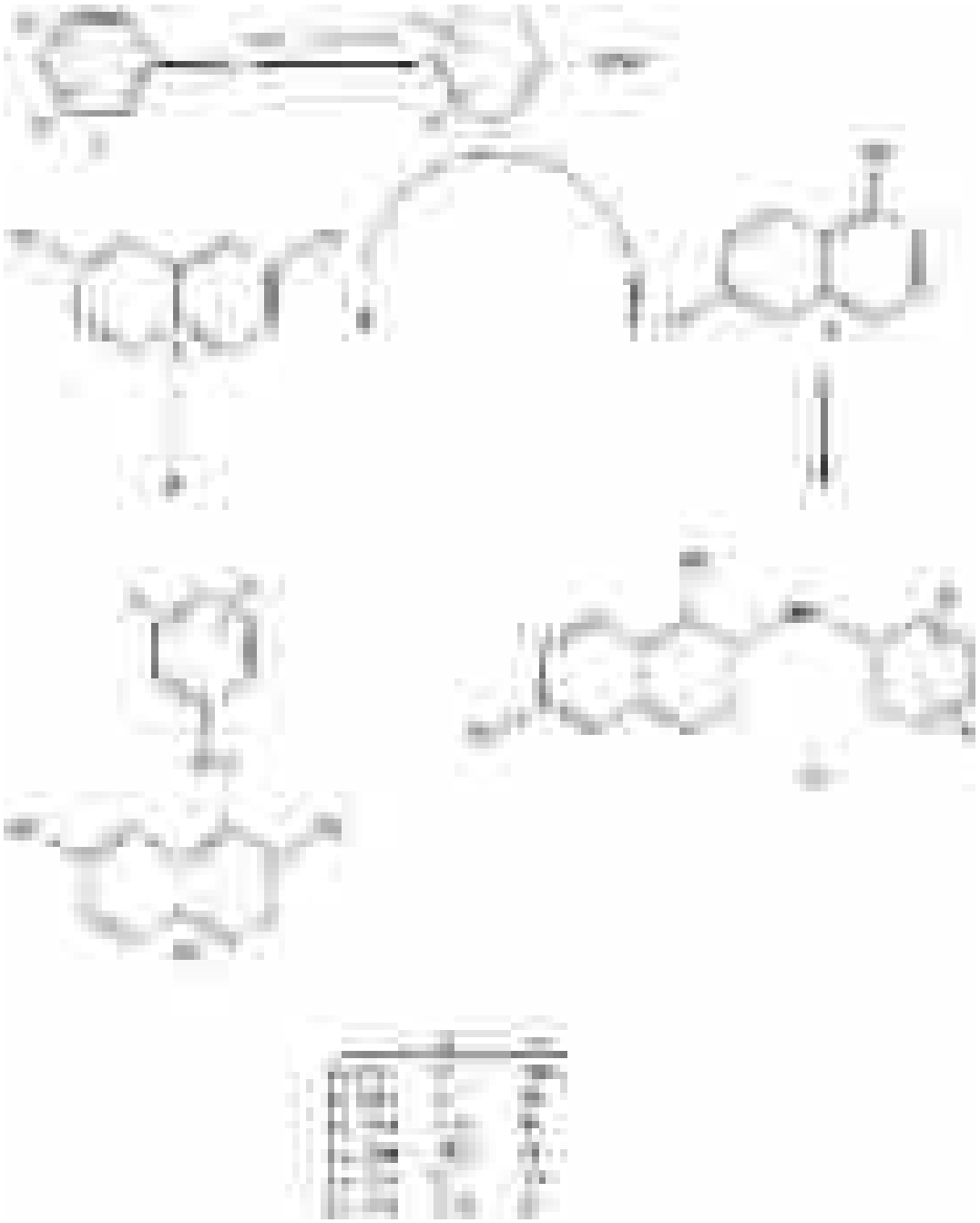


Figure 2

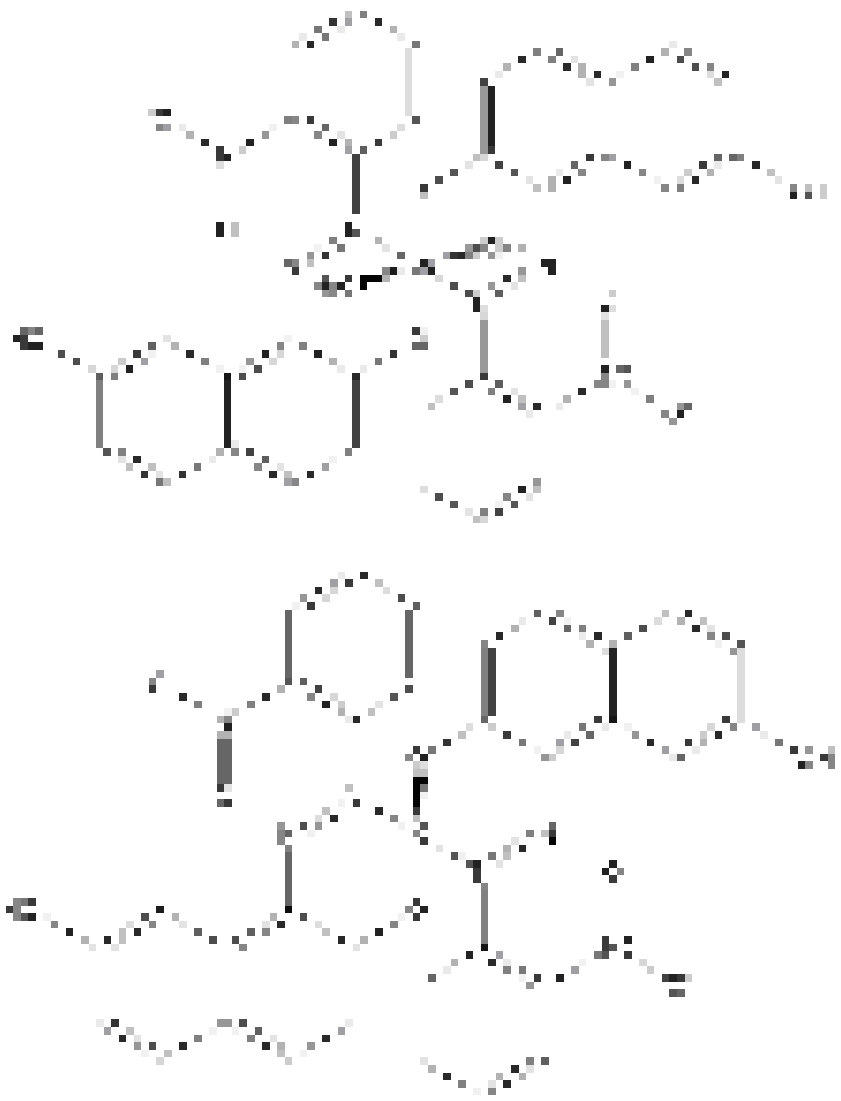


Figure 3

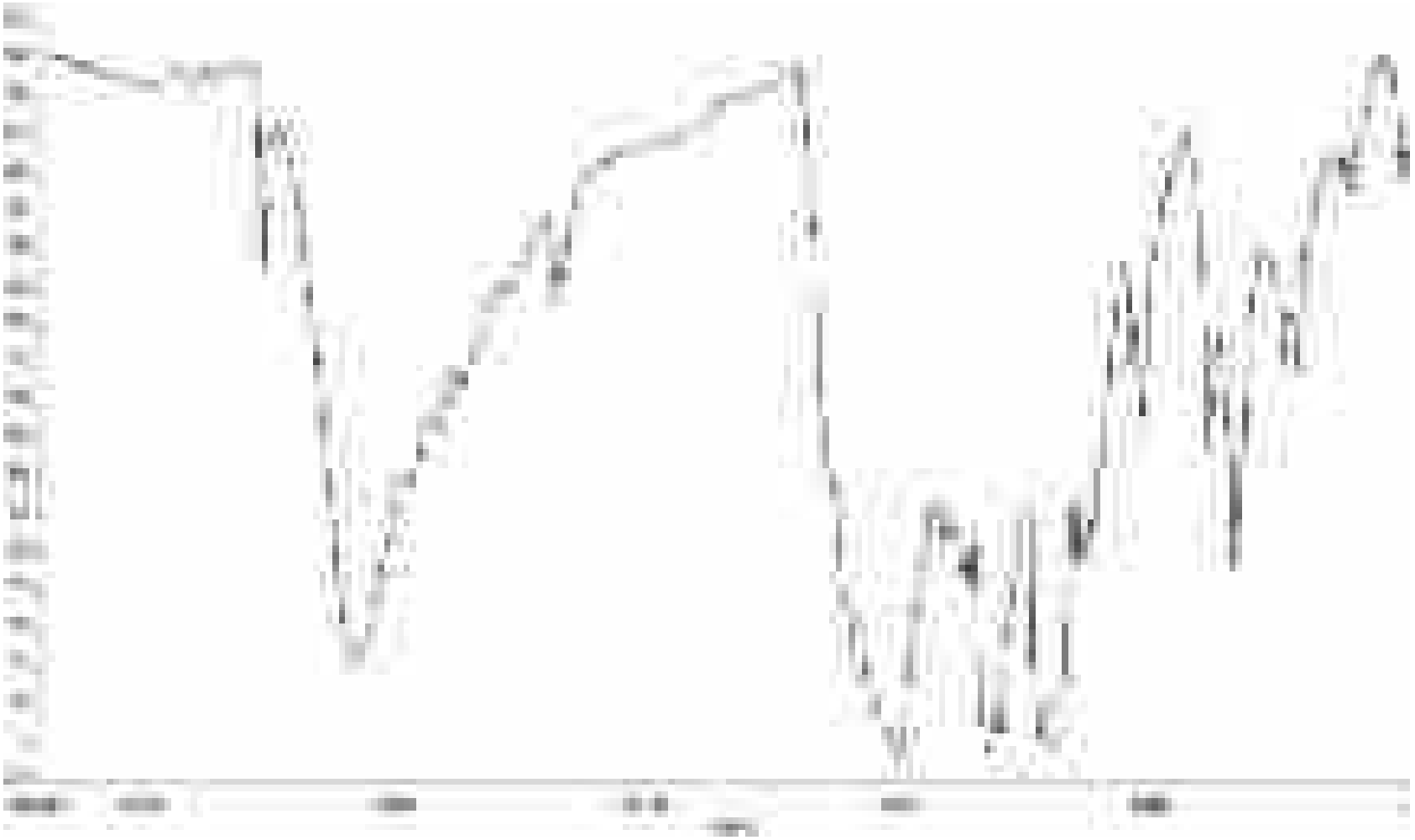


Figure 4

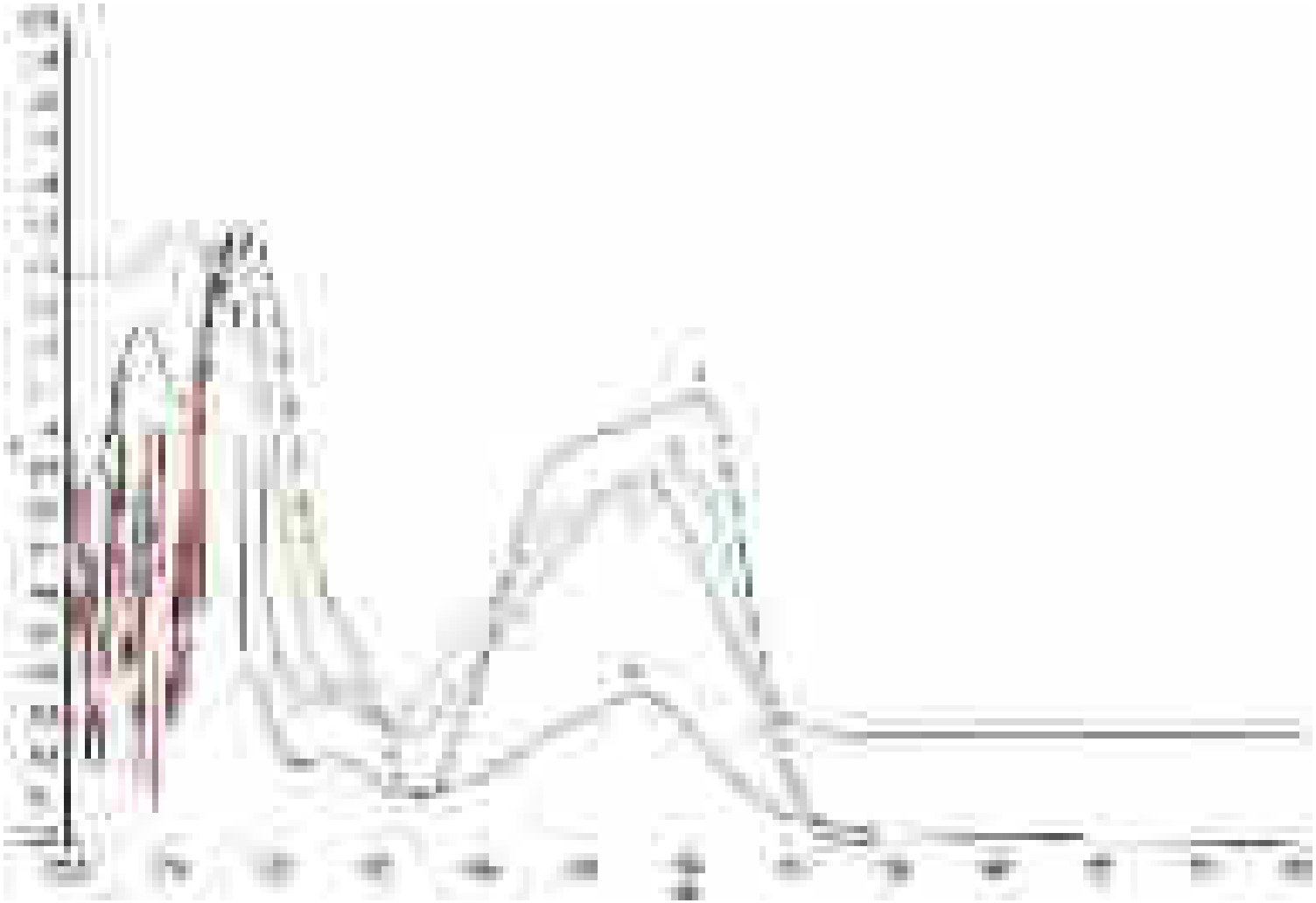


Figure 5

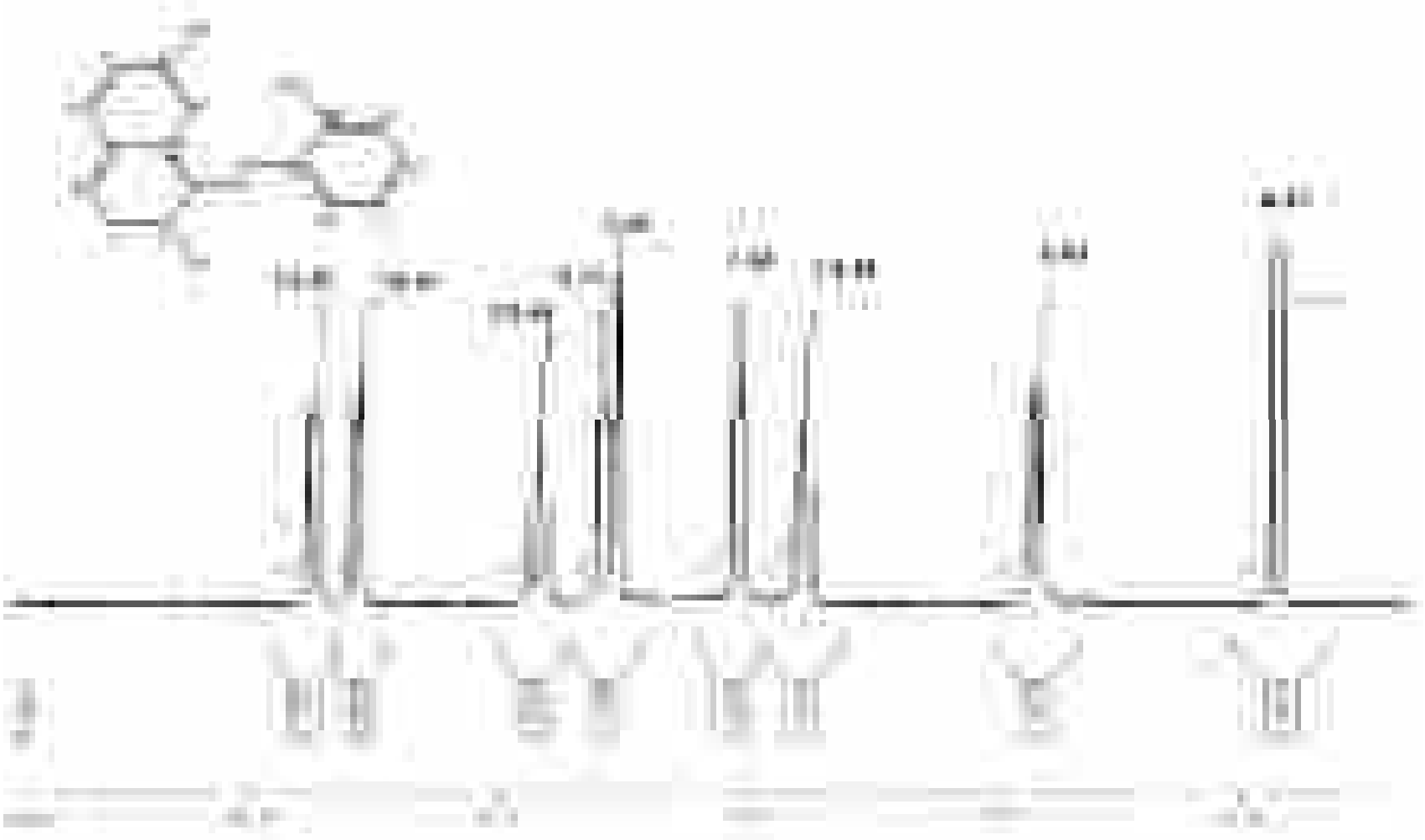
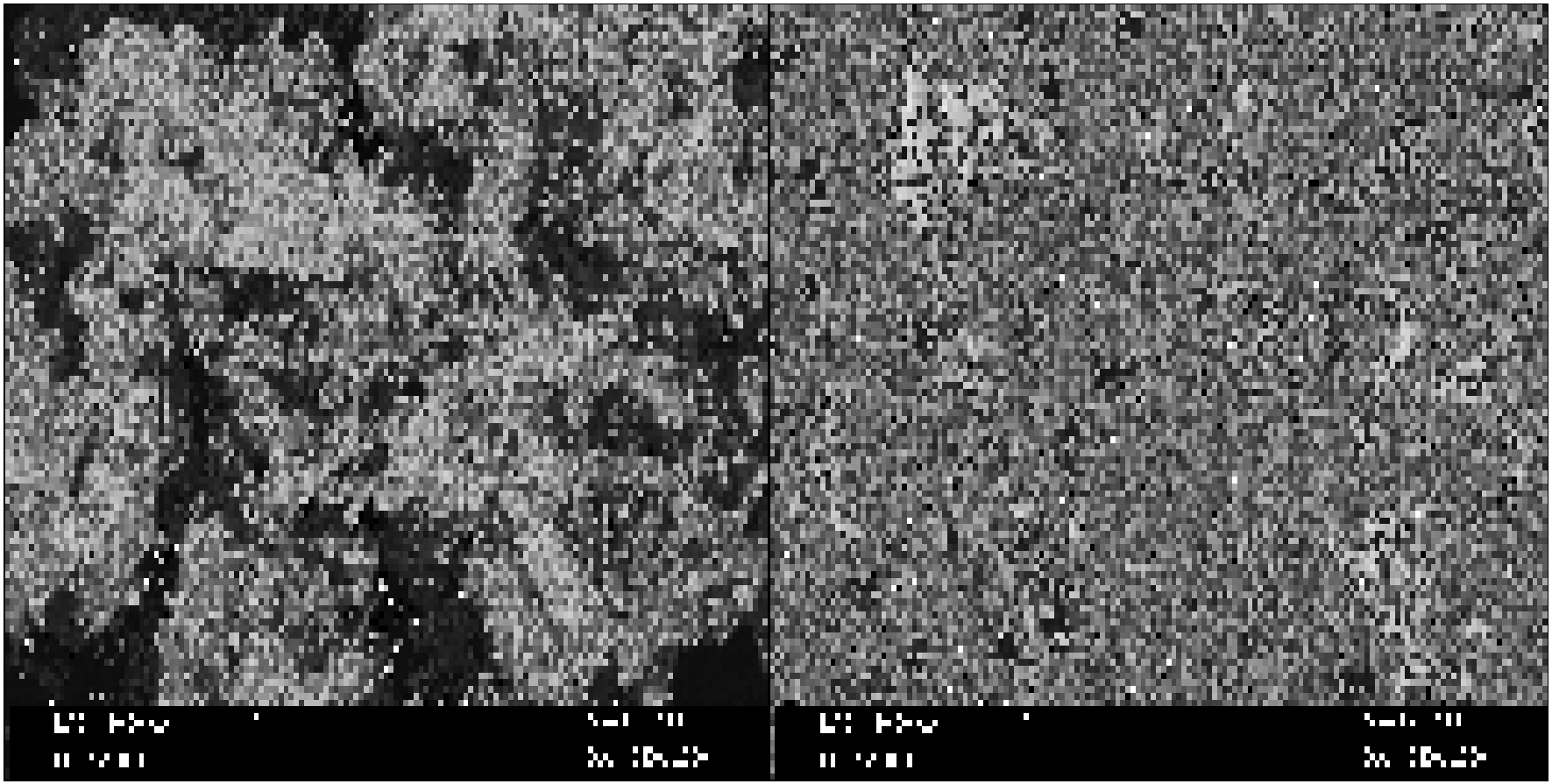


Figure 6



(a) **(b)**

Figure 7

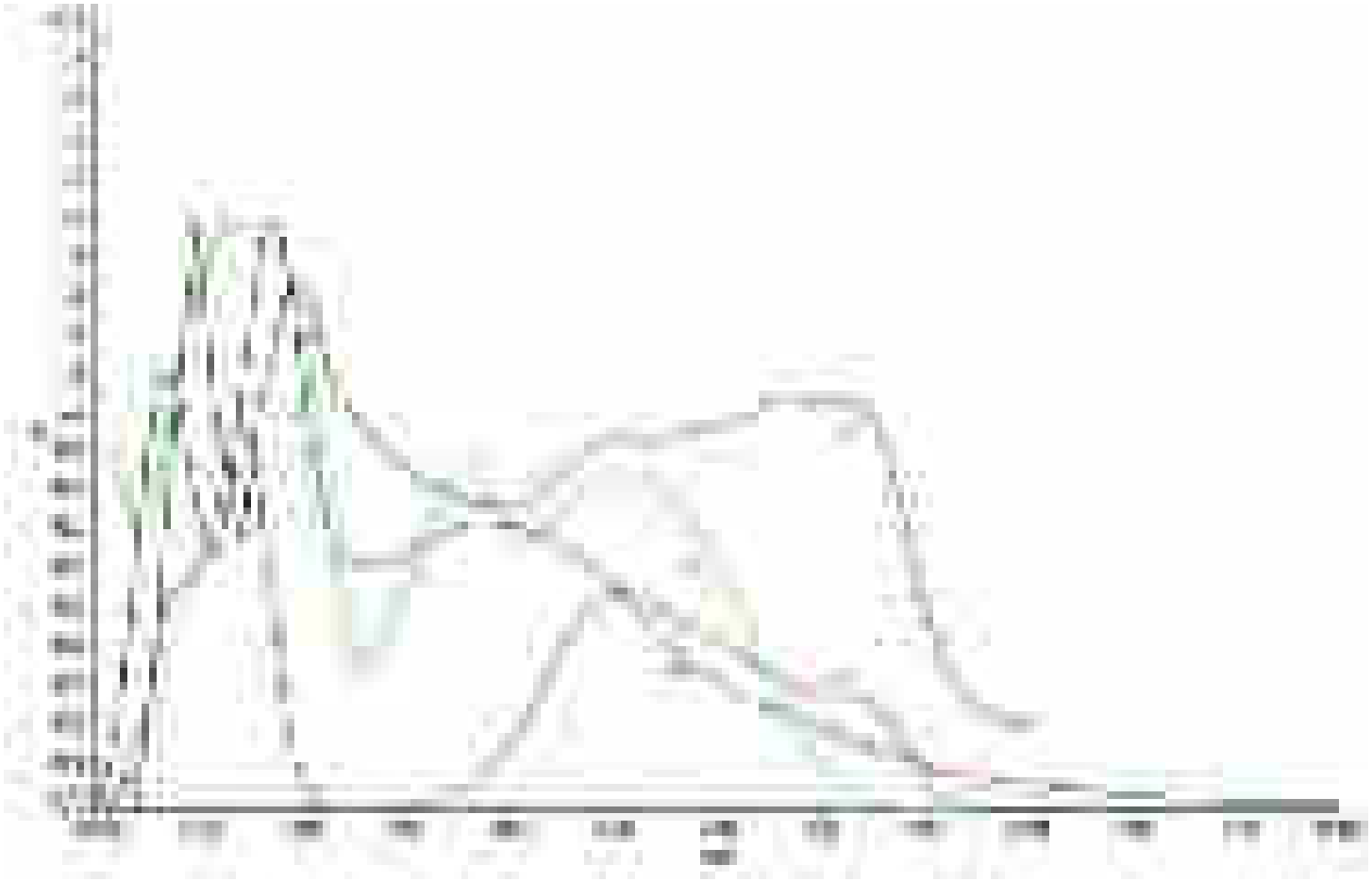
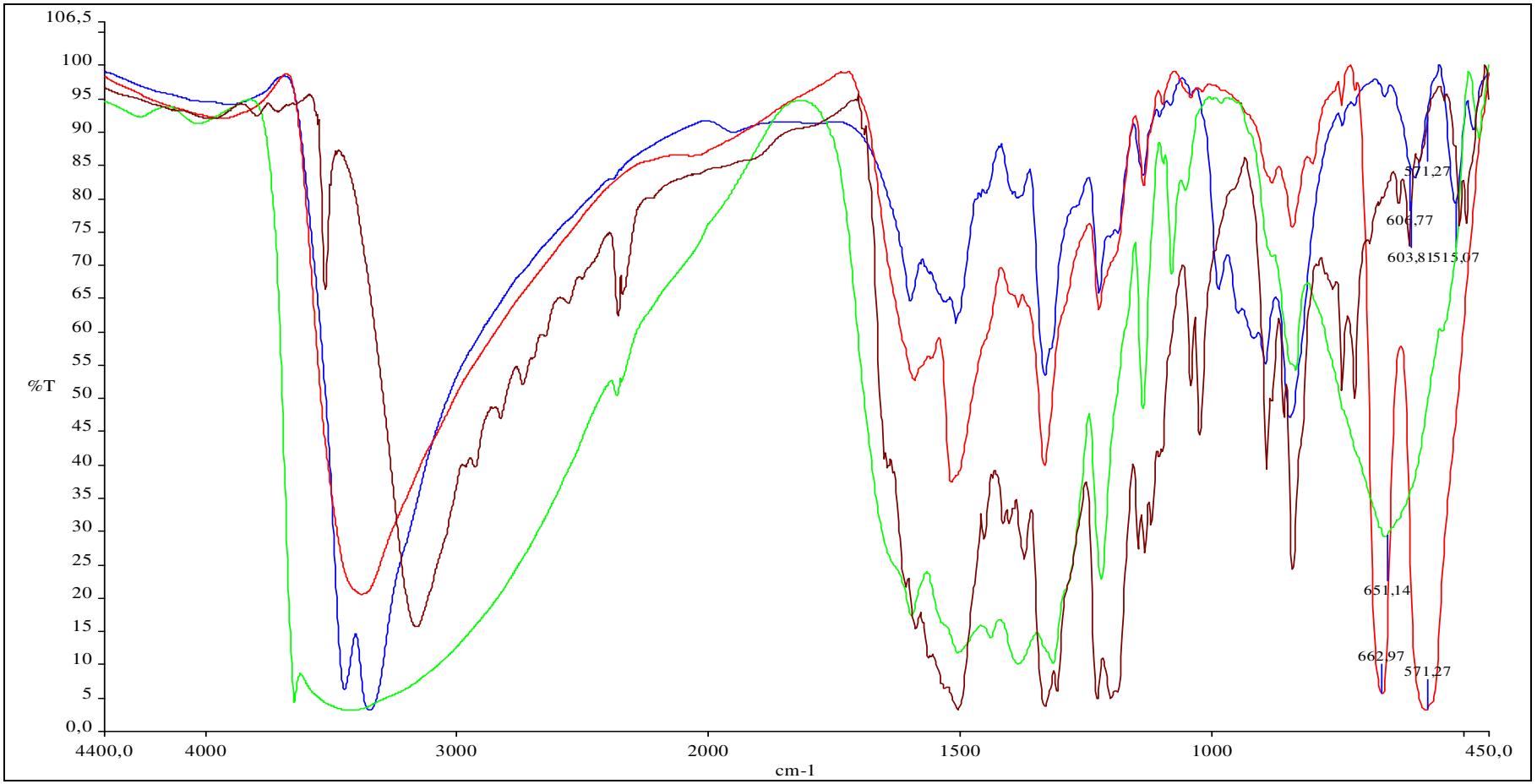


Figure 8


106,5
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0,0
%T
4400,0
4000
3000
2000
1500
1000
450,0
cm-1
571,27
606,77
603,81515,07
651,14
662,97
571,27

Tables

Table 1.

Compound	Color	M.wt.	Yield %	M.P ^oC	Calcd.%(Found)		
					C	H	N
L_1	Brown	343	86	219	55.90(55.87)	2.90(2.87)	12.21(12.12)
$[L_1]_2Co[H_2O]_2$	Black	780	40	>350(d)	49.24(48.96)	2.81(2.71)	10.76(10.54)
$[L_1]_2Cu$	Black	748	48	>350(d)	51.31(50.98)	2.40(2.19)	11.21(11.10)
$[L_1]_2Ni$	Black	744	45	>350(d)	51.64(51.10)	2.41(2.31)	11.28(11.32)
L_2	Brown	298	80	251	64.32(64.12)	3.68(3.55)	9.37(9.12)
$[L_2]_2Co[H_2O]_2$	Black	690	44	>350(d)	55.66(55.10)	3.47(3.34)	8.11(7.99)
$[L_2]_2Cu$	Black	658	31	>350(d)	58.32(58.12)	3.03(2.97)	8.49(8.33
$[L_2]_2Ni$	Black	654	38	>350(d)	58.75(58.64)	3.05(2.50)	8.56(8.35)
L_3	Brown	309	76	215	62.13(62.21)	3.55(3.33)	13.57(13.42)
$[L_3]_2Co[H_2O]_2$	Black	711	44	>350(d)	54.01(53.92)	3.36(3.09)	11.80(11.68)
$[L_3]_2Cu$	Black	680	38	>350(d)	56.50(56.34)	2.94(2.82)	12.35(12.21)
$[L_3]_2Ni$	Black	675	55	>350(d)	56.91(56.69)	3.96(3.84)	12.43(12.27)
L_4	Brown	344	75	249	55.80(55.34)	3.48(3.43)	8.13(8.04)
$[L_4]_2Co[H_2O]_2$	Black	781	45	>350(d)	51.22(50.96)	3.32(3.12)	7.16(7.04)
$[L_4]_2Cu$	Black	750	47	>350(d)	49.17(48.98)	2.93(2.80)	7.46(7.10)
$[L_4]_2Ni$	Black	745	59	>350(d)	51.56(51.40)	2.95(2.81)	7.51(7.44)
L_5	Brown	333	85	230	57.67(57.55)	3.00(2.98)	8.40(8.37)
$[L_5]_2Co[H_2O]_2$	Black	759	35	>350(d)	50.61(50.44)	2.89(2.69)	7.37(7.30)
$[L_5]_2Cu$	Black	727	39	>350(d)	52.79(52.66)	2.47(2.39)	7.69(7.77)
$[L_5]_2Ni$	Black	723	47	>350(d)	53.15(52.96)	2.48(7.40)	7.75(7.65)
L_6	Brown	309	88	216	62.13(62.17)	3.55(3.42)	13.57(13.53)
$[L_6]_2Co[H_2O]_2$	Black	711	43	>350(d)	54.01(53.95)	3.36(3.29)	11.80(11.76)
$[L_6]_2Cu$	Black	680	46	>350(d)	56.50(56.42)	2.94(2.88)	12.35(12.27)
$[L_6]_2Ni$	Black	675	47	>350(d)	56.91(56.72)	3.96(3.64)	12.43(12.32)

Table 2.

Compound	*v*OH	*v*C-H	*v*C=C	*v*N=N	*v*C-O	*v*OH	X_1	X_2	O-Met. N-Met.
L_1	3522-3160	2925	1643-1531	1504	1342	1226-1187	-	-	-
L_1-Co	3445-3345	-	1599	1504	1331	1223-1186	1384	741	656-597
L_1-Cu	3379	-	1590	1507	1332	1223-1134	1384	742	660-574
L_1-Ni	3645-3417	-	1595	1503	1315	1219-1136	1385	745	638-469
L_2	3160	2960	1645-1531	1504	1326	1181-1045	1373	-	-
L_2-Co	3418	-	1602-1541	1502	1318	1223-1137	1393	-	660-568
L_2-Cu	3551-3887	-	1599-1520	1487	1329	1222-1137	1367	-	665-559
L_2-Ni	3411	-	1599	1491	1316	1217-1134	1385	-	648-582
L_3	3140	2920	1604-1529	1504	1321	1225-1189	1365	-	-
L_3-Co	3567-3309	-	1597-1526	1487	1312	1221-1173	1391	-	520
L_3-Cu	3678-3427	-	1600	1506	1334	1216-1130	1384	-	655-583
L_3-Ni	3664-3420	-	1591	1484	1314	1218-1135	1383	-	646-470
L_4	3157	2965	1651-1531	1503	1305	1227-1118	1200	-	-
L_4-Co	3506-3424	-	1599-1543	1488	-	-	1220	-	657-532
L_4-Cu	3631-3418	-	1630	1482	-	1032	1218	-	665-457
L_4-Ni	3647-3428	-	1595	1484	1314	1215-1137	1219	-	650-468
L_5	3440	-	1630-1528	1500	1340	1181-1045	-	745	-
L_5-Co	3418	-	1601-1534	1471	1334	1239-1132	-	744	668-583
L_5-Cu	3631-3416	-	1574	1487	1333	1095	-	745	667-573
L_5-Ni	3643-3403	-	1591	1495	1338	1260-1087	-	-	620-528
L_6	3440-3166	-	1649-1530	1503	1331	1227-1118	-	775	-
L_6-Co	3451-3358	-	1592-1531	1494	1321	1242-1137	-	756	666-532
L_6-Cu	3395	-	1592-1516	1474	1318	1217-1083	-	745	664-541
L_6-Ni	3424	-	1597	1506	1315	1219-1078	-	731	650-536

Table 3.

Compound	A_1		A_2		A_3		A_4	
	λmax nm	εmax. $M^{-1}cm^{-1}$	λmax nm	εmax $M^{-1}cm^{-1}$	λmax nm	εmax $M^{-1}cm^{-1}$	λmax nm	εmax $M^{-1}cm^{1}$
L_1	237	2.56	282	4.44	328	0.12	475	2.07
L_2	241	1.48	274	1.29	332	0.56	483	1.00
L_3	247	3.47	275	6.57	-	-	471	1.18
L_4	240	1.62	294	1.50	329	0.14	486	1.34
L_5	243	4.11	292	2.93	328	0.22	470	2.38
L_6	246	3.85	296	6.07	329	0.61	460	1.81

$^{\varepsilon}$, Molar absorptivity at the absorption maximum.

Table 4.

Compound	1-H	2-H	3-H	4-H	6-H	7-H		8-H	9-H		12-H
	13-H	14-H	15-H	16-H							
L_1	-	15.11 (OH)[a]	6.67[b] J=7.34	6.81[b] J=7.85	6.42[b] J=9.57	7.45[b] J=7.85	12.90 (OH)[f]	6.19[f]	7.63[d]	7.52[b] J=8.44	-	8.37[f]	-
L_2	-	15.36 (OH)[a]	6.82[b] J=8.17	6.92[b] J=8.25	6.64[b] J=9.25	7.43[b] J=7.34	10.24 (OH)[f]	6.18[f]	7.82[d]	7.82[d]	-	7.62[d]	7.58[d]
L_3	-	16.21 (OH)[a]	7.71[b] J=8.80	6.92[b] J=8.41	6.44[b] J=9.61	7.53[b] J=8.42	10.09 (OH)[a]	7.80[a]	8.30[b] J=8.32	7.94[c] J=8.35 J=7.31	7.39[c] J=8.40 J=8.40	8.23[b] J=7.11	-
L_4	-	15.71 (OH)[a]	6.82 J=8.76	6.95 J=8.32	6.18[b] J=8.14	7.43[b] J=8.21	10.87 (OH)[b]	7.53[a]	7.65[d]	7.84[d]	-	7.65[d]	7.84[d]
L_5	11.33(OH)[a]	7.52[b] J=8.55	7.72[b] J=8.56	-	7.75[a]	10.10 (OH)[a]	6.83[b] J=9.04	7.13[b] J=8.52	8.26[a]	-	7.87[b] J=9.82	8.11[b] J=9.06	-
L_6	15.98(OH)[a]	6.92 J=6.93	7.39 J=6.27	-	6.21[a]	10.23 (OH)[a]	6.38[b] J=9.17	6.84 J=8.63	8.28 J=8.8	7.82 J=9.44	-	7.75 J=9.44	7.58 J=8.49

[a] singlet.
[b] Doublet.
[c] Triplet.
[d] Multiplet.
[f] Broad singlet

Table 5.

Comp.	μ_{eff} (μ_B)	$\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$ transitions(nm) (λmax in DMSO)	d→d transitions(nm) (λmax in DMSO)
L_1		215, 251, 495	-
L_1-Co	4.54	232, 288, 465	730
L_1-Cu	1.98	226, 300, 479	-
L_1-Ni	2.45	248, 296	533
L_2		264, 378, 453	-
L_2-Co	3.98	251, 316	-
L_2-Cu	2.15	236, 265, 453	-
L_2-Ni	2.34	233, 285, 387	-
L_3		231, 290, 488	-
L_3-Co	4.21	225, 238, 279	-
L_3-Cu	2.10	238, 297	508
L_3-Ni	2.76	228, 303	-
L_4		228,290, 299, 451	-
L_4-Co	4.24	303, 435	677
L_4-Cu	2.17	327, 435	520
L_4-Ni	2.96	261, 299, 442	-
L_5		252, 299, 482	-
L_5-Co	3.99	251, 277, 311	516
L_5-Cu	2.21	248, 300	526
L_5-Ni	2.92	211,251, 319, 434	-
L_6		248,306, 479	-

L_6-Co	4.45	281, 382, 439	513
L_6-Cu	1.88	236, 283	503
L_6-Ni	2.27	236, 258, 457	-

THE END OF LOCAL AGENDA 21 AND ITS TRANSITION TO THE CITY COUNCILS IN TURKEY

Dr. Zuhal Önez Çetin Ph.D*

Uşak Üniversitesi İktisadi ve İdari Bilimler Fakültesi,

Kamu Yönetimi Bölümü,

1 Eylül Kampüsü UŞAK/ TURKEY

E-mail: zuhal.cetin@usak.edu.tr, zuhalonez@gmail.com

∗ Corresponding Author

Abstract

Local Agenda 21 was submitted to local governments at the UN conference on the Environment and Development (UNCED) in Rio de Janeiro in 1992. Local authorities in each country called upon to undertake a consultative process with their citizens and achieve a consensus on a Local Agenda 21 for their communities. In this context, one of the most important achievements of the Turkey LA21 Program is the entrance of the city councils in our lives as the legitimate partner formations which have no corporate entity before and their finding place at the Article 76 of the Turkish Municipal Law No 5393. Now, LA21 program ended in Turkey which is the basic implementation systematic of sustainable development and local governance on a larger scale, and the program is sustained within the context of the city council which is a formation that develops the urban consciousness, supports the urban rights and law and develops the human relations at the urban scale. Within the framework of this study, the transition of LA21 program to the city councils in Turkey has been examined in a historical perspective. At the second step, the basic dynamics of the city councils have been analyzed with the help of the By-Laws of the city council by presenting the formation of the city councils, responsibilities, working principles, and its financial structure. In this context, the possible strengths and weaknesses of the city councils will be put forth. At the last step, solution proposals will be discussed in order to enhance the current functioning of the city councils in Turkey.

Keywords: Local Agenda 21 (LA21), City Councils, Local Governments, Municipal Administrations

I. Introduction

I.1. The Historical Process of Local Agenda 21 and Its Transition to City Councils

Local Agenda 21 (LA21) emerges from the Agenda 21(A21)[1] action plan was prepared for global concerns. However, the problems and the solutions which are being addressed by A21, have their roots in local activities that Chapter 28 was integrated to this action plan at the Rio Summit for the participation and cooperation of local authorities in fulfilling the global targets. With this chapter, local authorities in each country are called upon to undertake a consultative process with their citizens and achieve a consensus on a LA21 for their communities. The aim of the process is promoting the solutions of sustainable development at the local level, with the integration of all local partners to the implementation, planning, and decision-making progresses of local government. As maintained by the results of the United Nations Conference on Environment and Development (UNCED, 2002: 2), LA21 process involves:

• Managing and improving the local authority's environmental performance,

• Integrating sustainable development aims into local authorities' policy and activities,

• Awareness raising and education, consulting, and involving the general public,

• Partnership

• Measuring, monitoring and reporting on progress towards sustainability.

In this regard, Turkey was affected by A21 process, not at the beginning of the Rio summit, Habitat II had a big impact on sustainable development discussions in Turkey, this conference led to a good environment for speeding up the preparatory process of Turkey's National Report and Plan of Action (UNDP, 2001: Summary). In Turkey, the process LA was launched in 1992. In Turkey, in the scope of the LA21, UNDP and International Union of Local Authorities, Section for the Eastern Mediterranean and Middle East region cooperated. Milestones of this cooperation are i) Promotion and Development of LA21s in Turkey to encompass a number of pilot cities of varying sizes from all over the country to conduct their LA-21 processes, ii) Implementing Local Agenda 21s in Turkey, designed as continuation of the first phase was converted into the 'Turkey Local Agenda 21

[1] For details, see, Agenda 21 is an action plan for sustainable development into the next century; it sets the objectives in a number of programmed areas, and identifies the activities which governments and others should consider. Agenda 21 was drawn upon as a global agenda for 21st century and a commitment to a sustainable development; which meets the needs of the present generation without compromising the needs of the future generations. This action plan begins with this sentence "humanity stands at a defining moment in history". A new global partnership model was suggested for the solution of global problems at this summit (UN, 1992: 10).

Program' by virtue of the incorporation of a number of sub-projects, coupled with the inclusion of new local authorities to attain over 50 partners, iii) Localizing the UN Millennium Development Goals and World Summit on Sustainable Development Plan of Implementation through the Turkey LA-21 Governance Network, aiming at institutionalizing LA-21 processes and mechanisms through campaigns and capacity building initiatives and iv) Localizing the UN Millennium Development Goals in Turkey through the Local Agenda 21 Governance Network, strategy of which rests on participatory local governance as the basic means for the civil society and citizenry to mobilize local level action for achieving the MDGs.

In this framework, it is beneficial to carry on the discussion with the position of the city council at LA21 process in Turkey. At the initial stage of the LA21 program in Turkey, at the Official Gazette dated 6 March 1998, there was no expression concerning the city councils; the only target represented concerning the city council is the clarification that "*a participation mechanism's formation at the urban scale for the objective to determine the local problems, their causes and activity areas towards the solution of those problems at the formation of a consultative forum towards the development of the dialog between the local interest groups*" (Emrealp, 2010: 14). Afterwards, at the Turkish Municipal Law No 5393 article 76 enforced in 2005, the city council is envisaged as a mechanism that enables only 'consultation' that has no executive authority unlike the practices and examples of the west (Çukurçayır, 2011: 171). Finally, at the 12 November 2013 dated Official Gazette, city council is defined as "*City councils are the unique governance mechanisms which gather the central government, local government, and civil society around the collaborative partnership with a formation peculiar to Turkey* (Emrealp, 2010: 14).

In this respect, the Bylaws of the city council prepared by the Ministry of Interior that determined the working principles and procedures of the city councils, and put into force with the published Official Gazette No.26313 dated 08.10.2006. The common fundamental issues have been put forward in related with the city councils by the Bylaws of the city council and the formations that were set up in the names of the city parliament and city convention, etc. within the framework of LA21 turned to the city council. Finally, at the prior term of 2009, some amendments had been made at the By-Laws of the city council. The regulation concerning the changes at the city councils' was published at the Official Gazette No.27250 dated 6 June 2009 (Emrealp, 2010: 15).

II. The By-Laws of The City Council

ARTICLE 1(1):

The purpose of the By-Laws of the city council in Turkey can be listed as follows; developing the urban vision and the awareness of citizenship, protecting the city's rights and the law, and regulating the working procedures and the principles where they are attempting to realize the principles of sustainable development, environmental awareness, social assistance and solidarity, transparency, accountability, participation, governance, and decentralization.

ARTICLE 4 (1): At the implementation of this regulation:

The city council is defined as follows:

> *The city councils are the democratic formations and governance mechanisms based on common sense and compromise with the spirit of the partnership of the central government, local government and the public institutions in the nature of the professional organizations meet around the law of citizenry, define the development priorities, problems of the city, the vision on the basis of the sustainable development principles, develop solutions*.

Furthermore, the councils and the working groups are defined as follows:

> *The participatory formations that are established on a voluntary basis that targeting the contribution of the variety sections of the society especially the women and the youth councils and their taking of active role at a qualified and livable city, based on governance and within the context of the sustainable development*.

The city council's partnership covers the General Board membership, as well as the women and the youth councils, working groups and special interest groups which have no corporate entity. Additionally, those participatory platforms are taking its power from the 'equal partnership' understanding. At the By-Laws of the city council, the councils and the working groups are counted within the organs of the city council (Emrealp, 2010: 30).

At the By-Laws of the city council, the first steps that are needed for the formation of the city council are put into order with the Article 5;

The Formation of the City Councils, Responsibilities and Working Principles:

ARTICLE 5– (Official Gazette-6/6/2009-27250)

(1) The city councils shall be established at the places where there is a municipal entity with the composition of the members delineated in the Article 8 within three months following the general elections results of local governments.

(2) The city council General Board shall convene upon the invitation of the mayor to hold its first meeting. The General Board conveying under the presidency of the mayor shall elect a Charing Board consisting of at least three persons from amongst its members to chair the meeting.

(3) After the formation of the Charing Board, the city council Executive Committee and the head of the city council shall be elected.

The Functions of the City Council;

ARTICLE 6 – (1):

a) The provision of the widening of the democratic participation, the development of the citizenship rights and consciousness of living together respectfully, adopting the multi-partner and multi-actor governance approach at the local scale.
b) The provision of the sustainable development and the preparation and application of the plans oriented towards addressing the pertinent issues and problems.
c) Contribution to the formation of the collective wisdom involving the whole urban scale at the designation of the basic strategies and action plans, as well as in relation to their implementation and monitoring processes.
d) Development of the participation, democracy, and consensus building around the subsidiarity principle.
e) Protecting and developing the historical, cultural, natural, and similar values related to the urban identity.
f) Contributing to the effective, efficient, and fair usage of the urban resources.
g) Supporting the programs that developed the urban life quality based on the sustainable development approach and the programs responsive to the environment and targeting poverty alleviation.
h) Contributing to the development and institutionalization of the civil society.

i) Increasing the effectiveness of the children, the youth, the women and the disabled in the social life and ensuring that they take up an active role at the local decision-making mechanisms.
j) Contributing to the realization of the transparency, participation, accountability, subsidiarity principles in the city administration.
k) Forwarding of the opinions developed in the city council to the concerned municipality to be evaluated.

In addition to that the guiding principles of the city council, each having a special importance and priority in terms of embracing all aspects of local governance and complementing the duties of the council are delineated in Article 7 of the By-laws, as follows (Emrealp, 2011: 18):

ARTICLE 7 – (1) The city council continues its working principles at the basis of below principles;

a) Guiding the cities toward a livable future in the integrity of the principles of active participation, partnership in the solution, the sense of belongingness to the city within the context of LA21 process,
b) Realizing the basic principles towards the city and city life that are signed and approved by the Turkish Republican State at the United Nations' Summits and the other international agreements,
c) Prioritizing the development of a city vision and responsible citizenship, preservation of the urban rights and the rule of law, principles of sustainable development, responsiveness to the environment, mutual social assistance and solidarity, transparency, accountability, and the participation and subsidiarity.
d) Forming the decisions and the proposals of the city council with an unbiased and neutral manner, with due consideration to the international developments and specific conditions of the country.
e) Taking participation and consensus based upon the collective wisdom as a starting point.
f) Adopting the result-oriented working culture by realizing the change and the innovations.

When the city council is integrated with multi-variety and wide range responsibility area; it is seen that the working principles has a context and content that open the way of the development of a new administrative approach that embracing the whole fields of the local governance at the target of the development of the environment and the life quality of the council. The principles of the city council that each of them has a different priority and significance are regulated at the 7th Article of the By-

Laws that carrying an integrity with the responsibilities of the city council. The working principles of the city council has a special basis in the aspect of the strengthening the ties with the LA21 processes. In this context, it is seen that the working principles especially the articles of a, b and c have a key function at setting up the bridge between the city council and LA21 processes (Emrealp, 2010: 24).

Furthermore, the organs of the City Council are delineated in Article 9th of the By-laws of the City Council dated 8 October 2006 as the General Board, Executive Committee and Assemblies, and Working Committees, whereas the head of the city council has been added amongst the organs of the City Council via the revised By-laws dated 6 June 2009 (Emrealp, 2011: 15).

ARTICLE 9- (1) The city council is composed of these organs listed below:

a) General Board
b) Executive Commitee
c) Assemblies and Working Committees
d) The Head of the City Council

In this context, the By-Laws of the city council also determines the membership to the city council with the Article 8.

ARTICLE 8:

(1) The city council is established in order to bring the central government, local government, public institutions in the nature of professional institutions and civil society under the partnership approach and consists of the following persons, institutions and organizations listed below;

a) The highest statute local administrative official or its representative (namely, the Governor in the province and the Sub-governor in the district),
b) The mayor or his/ her representative,
c) Public institutions or organizations' representatives designated by the Governors in the provinces and by Sub-governors in the districts (not to exceed ten representatives),
d) Neighborhood heads (all neighborhood heads shall be members of the Council in municipalities encompassing up to 20 neighborhood administrations. In other municipalities, the neighborhood heads, gathering together upon the invitation of the mayor, shall select among themselves their representatives, which should not exceed 30 percent of the total

number of neighborhood heads, and provided that the number of representatives is not less than 20),

f) The political party representatives (those with an organization in the respective locality),
g) At least one representative from the universities and not more than two representatives in case there is a single university, one representative from each university in the case of two or more universities,
h) Representatives from professional organizations having the status of a public institution, trade unions, notaries, bar associations and the representatives of the related associations and foundations,
i) The representatives (one from each) of the assemblies and working groups established by the city council.

Furthermore, the Financial Structure of the City Council is clarified at the By-Laws of the city council at the Article 16. In this context, the city council should reach sufficient financial resources for its performing the functions in an efficient and flexible manner. The financial resources, the accompanied office space and equipment, and the staff should be provided by the municipal administration, and it is inevitable in respect of the roles and the functions of the local administration. On the other hand, the provision of in-cash and kind contributions by other relevant stakeholders is also of great importance within the context of the partnership approach. Whereas the By-laws dated 8 October 2006 did not include an expression concerning the financial support to be ensured to the city council by the municipal administration. In this regard, the revised By-laws dated 6 June 2009 has an explicit clause at opening up the ways for relevant financial and other contributions under the heading 'Financial Structure of The City Council'. Those expressions have been located as follows:

ARTICLE 16/A:

(1) The municipalities shall provide in kind and cash contributions by the allocation of the allowances in their budgets.

In addition to that, there is a legal bottleneck at the allocation of the budget to the city council by the municipal administration which is in the nature of its local organ. On the other hand, the uncertainty has been still carrying on about how the resource allocation has been made to the city council which has no corporate entity.

III. The City Councils Problems in Turkey

There are no extensive and detailed researches that search for how the city councils perform their functions that are determined at the By-Laws of the city council. However, Turkish Republic at the Local Government Reform Program for reaching those targets of 'development of the democratic decision-making mechanisms at the local governments', 'enhancing the local governments' administrative/ financial autonomy, efficiency and accountability' and 'prospering the quality of the local public services and citizens access to them'; the study of the 'Strengthening the Local Participation Mechanisms and Current Status Detection' within the context of the Local Administration Reform Program (LAR) was carried out with the support of the European Commission on behalf of the Local Governments General Directorate conducted by UNDP [2]. The findings have been evaluated with the academic literature of the city councils in Turkey and a chart is prepared to exhibit the current status of city councils in Turkey. In this context, when an analysis is made generally on the problems of the city councils in Turkey, we see that city councils have been faced with four main problems as follows; legal problem area, managerial /organizational problem area, local citizens-NGOs relation problem and city council-municipal administration relation problem. These four problem areas are nourishing each other and a change and a transformation in one field is closely related to the other areas.

Diagram I- City Councils Problem Areas:

LEGAL PROBLEM AREA	LOCAL CITIZENS-NGOS RELATION PROBLEM
□ The decisions that are taken at the city council are only evaluated and taken into the agenda by the municipal council. □ The lack of binding of the taken decisions at the city council. □ The city councils' position at the participation process is indefinite. □ Task uncertainty problem.	□ The awareness on participation is not developed at the local community. □ The active citizenship concept is not developed. □ The lack of participation of the local citizens. □ The city councils are not contact with the local citizens.

[2] For detail, see, <http://www.lar.org.tr/uploaded/dosyalar/cb8d1b7d40fb8d6751df908adde90fb0.pdf>.

	□ The unwillingness of the NGOs at the participation process.
MANAGERIAL /ORGANIZATIONAL PROBLEM AREA □ The city councils are depended to the municipalities in terms of finance. □ The formation of the organizational structure does not comply with the legal basis. □ The working group formation and continuity problems. □ Certain activities have been carried out by not informing the members of the city councils.□ Lack of inter-communication facilities between members. □ Members' different political tendencies can cause conflict at city councils. □ The people elected as the head of the city council feels responsible and accountable not towards the local citizens but to the people who are effective at the practice of his/her election process. □ The political polarization.	CITY COUNCIL-MUNICIPAL ADMINISTRATION RELATION PROBLEM □ The city councils are seen as the sub-units of the municipal administrations (dependency problem). □The municipal administrations' administrative control and supervision on the city councils. □ The relationship between city councils and the municipalities is broken-off. □ The city councils activities are not indicated at the annual reports. □ The city councils are not participated to the strategic planning affairs. □ The activities that are belong to the municipalities responsibilities are seen as the works of the city councils. □ The decisions that are taken at the city council remain in the size of the advice to the municipal administration.

III.1. Legal Problem Area

The first legal problem area is concerning with the decisions that are taken at the city council; those decisions are only evaluated and are taken to agenda by the municipal council; and the taken decisions have no binding peculiarity that the decisions remain in the size of a recommendation to the municipal administration. In this regard, at the By-Laws of the city council article 14th related with the declaration of the decisions part, it was expressed that '*the taken decisions will be assessed*

at the first meeting of the municipal council and after that the city council is informed by the municipal administration and it is announced to the public opinion with the appropriate tools'. In this framework, the determiner is the municipal council or the mayor at the evaluation of the council opinions or at their achievement the nature of a decision or not. It is obvious that not meeting the hopes in related with the reflection of the city council decisions to the municipal council decisions, adversely affects the motivation of the council representatives which is left to the individual initiatives (Savut, 2011: 360).

The second legal problem is related with the participation of all local stakeholders and the local citizens to the local decision-making process. The city councils' position at the participation process is indefinite. In this context, the main influential thing that needs to be considered is related with the determination of the institutions that are invited to the General Board and gathered by the invitation of the mayor. At this issue, the 8th Article of the By-Laws of the city council has clear lines at the submission of framework; however different interpretations can be imposed to the determination at the (f) paragraph concerning the professional organizations in the nature of public institutions, trade unions, notaries, and related associations and foundations' representatives. In this regard, in particular, there is the concern that the mayor can invite the associations and foundations that close to him/ her and the mayor can exclude the others from the city council with the ground that they are not pertinent to city council affairs (Emrealp, 2010: 18).

The third legal based problem concerns with the By-Laws of the city council. Some of the legal provisions stayed insufficient in the functioning of the city councils in Turkey. First of all, at the provision of the By-Laws of the city council, it is demonstrated that the settlement of the city council by the municipalities is an obligation. At the By-Laws of the city council at the Article 5th; it is clarified that 'the city councils shall be established at the places where there is a municipal entity' (Özdemir, 2011: 44). In this regard, at the By-Laws of the city council, the establishment of city councils at local level is foreseen as an obligation. The the By-Laws of the city council oblige the establishment of the councils with pre-assumption of the whole cities city councils have the same willingness. However, this requirement concerning the city councils' establishment is not appropriate with the local democracy; because the willingness is the key factor at the participation process. As a result of this case at some city councils, the hoped activities cannot be carried out because the participation rate is low to the city council meetings (Özdemir, 2011: 44-45).

In addition to that, there is a legal bottleneck at the allocation of the budget to the city council by the municipal administration which is seen in the nature of its local organ in Turkey. On the other hand, the uncertainty has been still carrying on about how the resource allocation has been made to the city council which has no corporate entity. As a solution developed on this issue clarified as 'the expenses of the city councils that are deemed appropriate by the municipal administration are made to be met by the related departments of the municipal administration, primarily the department responsible from the financial resource of the city council is the Socio-Cultural Affairs Department'. In this regard, it is seen that, the search for the solution proposals appropriate to the formation, and the functioning of the council has been carrying on (Emrealp, 2010: 29).

III.2. Managerial/ Organizational Problem Area

One of the most important organizational problems in front of the city councils like the other participatory formations is the finance which is also discussed at the legal based problem area (Mercer and Jotkowitz, 2000: 163-181). In Turkey, most of the municipal administrations demand the allocation of a definite financial resource regarding the city councils at their budgets. The city councils cannot solve the financial structure and budget issues which hold an important place at the establishment and functioning of the city councils. The city councils are mostly perceived as a dependent participatory platform to the municipal administration because they are not independent in terms of their financial structure. Moreover, most of the municipalities' current budget proportions in the aspect of the realization of the basic functions are insufficient that this plight decreases the financial support to the city councils at their costs in Turkey. When this situation coupled with the bureaucratic obstacles, it becomes an influential limiting factor at the realization of the city councils' activities (Özdemir, 2011: 48). Particularly, the small city municipalities cannot support the city councils due to the economies of scale. The municipalities having limited budget in Turkey remain under the condition of deceleration of the functioning of the city council activities; because in general, they are under the anxiety of the provision of the local services and not losing the political power in their hands.

The second managerial/ organizational problem area is related with working groups of the city councils. The formation of working groups, their working contexts and sustainability have a great importance in terms of the city councils' contribution to the local level participation. In this respect, most of the city councils in Turkey cannot establish working groups that meet the needs of all sections of the society. Therefore, the working groups should be established in accordance with the problems of the cities and carried out their studies in a solution-oriented way. Furthermore, the

sustainability of the working groups is also critical for the effective functioning of the city councils' affairs in Turkey. The city councils in Turkey encountered with the unsustainability of the working groups problem. In this respect, the sustainability problem of the groups can be stemmed from the sensitivity level of the city council representatives to the urban problems and their solution development capacities.

The third problem at the organizational problem area is related with the communication between the municipal administration officials and city council members. In this context, certain activities have been carried out by not informing the members of the city councils in Turkey. Both the municipal council and the units of the municipality have no more information than the local citizens about the affairs of the city councils (Özden, 2010: 21). The activities are sustained by the Executive Committee without the knowledge of the members of the city council; and after that the municipal council announces the information on which countries, cities are visited and which works are done to the members, pretending as the works of the city council (Toprak Karaman, 2011: 9).

The last problematic issue concerning the managerial problem area is related with the mayor and his/ her political attitude. At the city councils' affairs, a political approach and the decisiveness having political nature should not be reflected for the provision of the maximum participation. However, the mayors have the tendency that holds back the city councils in their backyard at the position that supports themselves at their urban affairs. By the help of the city councils as their being of a living platform of the local politics, the games of the local politics replace the position of the participation mechanisms and the elit section of the society who are effective at the decision-making and application processes continue to benefit from the whole possibilities of the urban scale (Güneş and Beyazıt, 2011: 814). The people elected as the head of the city council feels responsible and accountable not towards the local citizens but to the people who are effective at the practice of his/ her election process. In this regard, a public trust should be created at the public opinion in terms of the participation of the local masses. In this way, the city councils can turn to the participatory platforms that determined at their settlement targets. Moreover, as a result of the studies done on various platforms findings' demonstrate that, the initiative at the application of the city councils' affairs is in the hands of the mayor, and it creates major problems at the functioning of council activities (Çukurçayır *et al.*, 2011: 304). It can be clearly stated that the effective working of the city councils is depended to the discretion of the mayors (Özden, 2010: 20). At many councils, the head of the council is the mayor, the deputy mayor or member of the municipal council. This case leads to the remaining of the city council activities in a narrow and limited sense. The head of the city council is entailed to be a facilitator at the public participation. The head of the city council should represent

mostly the middle class, and it would be more appropriate electing the head of the council from the different sections of the society periodically (Özdemir, 2011: 50).

III.3. Local Citizens-NGOs Relation

The first problem area concerning local citizens is about the awareness and recognition on participation. That participation culture is not developed at the local community for their participation to the local decision-making process in Turkey. The city councils in Turkey confronted with the recognition and know-ability/ awareness-raising problems. Particularly, the women councils coming to the front side at the cities and they gain an influential way concerning their effectiveness in comparison to the European countries and it paves the way for the perception of the city councils as the women councils (Güneş and Beyazıt, 2011: 810; Özden, 2010: 10).

Furthermore, the second problem is associated with the concept of the active citizenship which is not developed at the local community in Turkey for the effective functioning of the city council activities. First of all, it is not possible to talk about a real and a true local administration without responding the questions of 'who is the active citizen at the local participation process and how can we reach to the active citizen with a structural amendment'. It can be clearly stated that before surpassing the legal, economic, and political barriers in front of the active citizenship; it would be impossible to achieve participation concept based on citizenship (Güneş and Beyazıt, 2011: 810).

The third problem area concerning the local citizens is about the lack of participation of the local citizens (Özden, 2010: 10). At the other side, the city councils do not contact with the local citizens. In this regard, the voluntary participation to the city council and the services of the municipal administration foresees only the organized groups' participations at the urban field. However, the issues discussed at the city council should include the demands and wishes of the citizens, and the solutions should be produced by the public. In this context, in practice, it is seen that the solution proposals at the city councils meeting have been produced by the local officials attending to the meetings on behalf of the central government rather than the public. Namely, the participants at the city council are determined one by one at the By-laws of the city council, thereby, the citizens cannot take enough place at the local decision-making process at this formation. Besides, the appointed members of the central government are decisive at the decision-making and application processes owing to the reasons arise from the formation; and it is inappropriate with the

city council's anticipated participatory administration approach (Özdemir, 2011: 49-50). Even though the city council has the capacity to fill an important gap at the realization of the citizen-focused understanding, it lives problems at the representation of that approach, on the grounds that it does not put into practice the decisions taken by the local citizens. The citizens are still passive at the decision-making processes who are depended to the municipal services provided by the municipal administration that those problems lead to the lack of participation of the local citizens to the city council activities (Kutlu *et al.*, 2008: 234).

Indeed, Şen (2008: 60) declared that:

> *The city council as an institution has been governed by lots of institutions but the urban citizens/ individuals do not appear at this formation; the city which is not managed by the local citizens is not a city, but it is only the spreading of the center.*

The last problem is related with the unwillingness of the NGOs at the participation process. At the By-Laws of the city council, it is expressed that "*the general council is composed of public institutions in the nature of professional organizations, trade unions, notaries, and the representatives of the related associations and foundations*", it is understood that the widest participation section is formed by the NGOs (Şengül, 2004: 38). However, here by whom and how will the relatedness be designated and with which criteria is still uncertain. The city council as a LA21 organization, every representation from the public or the civil society is determined through organization. Thereby, it can be evaluated as a corporatist representation formation that supporting a certain plurality (Şengül, 2004: 38). In this sense, according to Şengül (2004: 37):

> *The city council is the tool of the LA21 that has the target to override the old 'selective representation'. However, when looking to the city councils, these participatory platforms are attached to the municipality except a few samples.*

Therefore, at the formations like the city councils based on entirely voluntariness, most of the civil society institutions are reluctant of at being participative, at having the sense of the belongingness to the city and at sharing the responsibility. It has many reasons such as social, cultural, and psychological and there are also people who claim that even the city council itself has a structure that leading to the unwillingness of the people at the participation to the decision-making process (Şen, 2008: 60).

III.4. City Council- Municipal Administration Relation Problem Area

The first problem concerning the city council and municipal administration problem area is the assumption that the city councils are seen as the sub-units of the municipal administrations. Even if the studies today, the city councils are mostly perceived as an organ of the municipal administration

and it is the reflection of the new kind of administrative tutelage relation on local citizens (Güneş and Beyazıt, 2011: 814). The city council is encountered with the turning of a unit of the municipal administration that made the legitimization of the acts of the local government rather than its basic functions of affecting the decision-making process, accountability, and the protection of the urban rights and law. So, there is the widespread conviction that the city councils have not been providing yet the hoped benefits with its current structure (Bulut, 2013: 127). Furthermore, at the By-Laws of the city council, there is no requirement concerning the relation of the head of the city council with the related municipal administration. Therefore, in many provinces, the head of the city council is the vice-mayor, deputy mayor and the mayor's consultant. In consequence of this situation, the city councils have been directed within the municipal administration under its control and orientation as a unit of municipal administration (Bulut, 2013: 131).

Besides, the second problem is associated with the municipal administrations' administrative control and supervision on the city councils which has also strong ties with the dependency problem. In that framework, the opinion is widespread that the city councils are generally under the influence of municipal administration. The Executive Committees of the city councils have been formed under the influence of the municipal administration (Özden, 2010: 12). At that context, one of the critical points is the strong participation at the local level requires strong local government. In Turkey, the financial and administrative autonomy of the local administrations' is problematic that the city councils remain as dressed participatory organizations (Güneş and Beyazıt, 2011: 811).

In this respect, the other problem is concerning with the relationship between the city councils and the municipalities which is broken-off between them. In Turkey, there is hardly any relationship with the city council and municipal administration. Furthermore, the legislative links pertaining institutional relations network between the city council and municipal organization cannot be set up. The institutional relations cannot be structured for the fulfillment and the evaluation of the activities by the units of the municipality. In this legislative background, the responsibilities of the municipal council representatives and the mayor towards the city council are not expressed explicitly at the functions and responsibilities list of the law of the municipal administration. The critical importance of the legal-institutional linkage does not take the required attention by the municipal officials and the representatives of the city council (Karaman, 2011: 9-10).

The fourth problem is related with the municipal administrations' annual reports and strategic planning affairs. In this respect, the city councils activities are not indicated at the annual reports and the city councils' representatives cannot participate to the strategic planning affairs. At that point**,** the

city councils' effectiveness requires the effective role-taking of the city councils' at strategic planning works and activities of the municipalities. The city councils cannot participate to the strategic planning process of the municipal administrations, however all affairs' decisions of the municipal administration are taken under strategic planning process. In this regard, strategic plan preparation and city council formation calendar is overlapped in Turkey; the city councils probably at best conditions can be integrated to the process at the revision of the strategic plan period (Özden, 2010: 15). Lastly, the activities that are belong to the municipalities responsibilities are seen as the works of the city councils. The city councils are oriented to the activities outside their tasks and philosophy, the routine and daily affairs of the municipal administrations in their responsibility areas are indicated as the works of the city councils (Karaman, 2011: 8).

IV. Proposals for the Effective Implementation of the City Council

In related with the legal problem area; first of all, the legal framework should be set up for the legitimization of the taken decisions at the city council; those decisions should reach a binding character. Besides, in order to solve the participation of all local stakeholders and the local citizens to the local decision-making process; the head of the city council should not behave politically in inviting the local stakeholders to the local-decision making process. Additionally, the relevant articles of the Municipal Law No 5393 and the By-Laws of the city council should be re-regulated to solve the allocation of the budget and the settlement of the city council issues. The solution of the financial problem also assists the solution of the dependency problem concerning the managerial based problem area. The procedure that how the municipal administration provide facilities and support to the city council should be clearly clarified at the By-Laws of the city council for the elimination of the local administration impact to the city council.

In this regard, the other managerial problem is seen at the working groups and the councils of the city council. Therefore, the city councils should create the possibilities at the establishment of the new groups focused on the solution of the city councils problems. Qualified councils should be created for the disadvantaged sections of the society (women, children, youth and disabled) for discussing the problems that they face at the urban life and developing the solution proposals (Özdemir, 2011: 50). Moreover, the works done by the working groups and the councils should be reflected to the decision-making mechanisms, and the results should be shared by the public opinion for a positive impact on the participation process (Keskin *et al.*, 2011: 321). Furthermore, the sustainability of the working groups should be provided for the effective functioning of the city councils' affairs in Turkey. The other managerial problem related with the two-way communication

between the city council and the municipal administration can be solved with a well-functioning information process. Lastly, the mayor should not reflect a political approach and the decisiveness having political nature for the provision of the maximum participation. Additionally, the third problem area related with the local citizens is about the awareness and recognition on participation. The participation culture is not developed at the local community for their participation to the local decision-making process that the necessary awareness raising campaigns should be arranged for the enlightenment of the local citizens by the municipal administration and the city councils in Turkey.

Furthermore, the legal, economic, and political barriers in front of the active citizenship should be surpassed to achieve participation concept based on citizenship. By the ingenuity of the city councils; the studies should be made that develop the citizenship consciousness; on the other hand the urban citizens' inclusion to the city who are remained outside the economic, social, and cultural life should be provided (Bulut, 2013: 163-166). Besides, the lack of participation of local citizens can be solved by the city council with including the demands and wishes of the citizens and with producing the solutions by the public rather than the appointed public officials (Bulut, 2013: 146).

Lastly, the city councils should pave the way for the integration of the NGOs to the city council decision-making process by surpassing the corporatist representation. One of the most important actors at the good governance in this process is the civil society (Keyman, 2007: 10-12). The civil society institutions should be the driving force and partner of the governance processes, and there should be more attempts that surpassing the reluctance of the civil society institutions at active participation at the city council.(Bulut, 2013: 146). The methods that promote the participation of the civil society organizations should be developed and their accessibility to the city council places and studies should be facilitated. The method that is developed to overcome these and similar difficulties and to avoid to harm the city council is the proposal which expresses that the list of the associations at the city can be made by the Ministry of Internal Affairs Associations' Department and the invitation can be made in that direction (Emrealp, 2010: 18). At this process, the civil society organizations which are related with the city council affairs come out by themselves, the reluctant stayed far away from the city council and the problem is solved at the application by itself with the sustenance of the participation of the institutions sensitive to the city council affairs (Emrealp, 2010: 19).

The fourth problem area is related with the relation between the city council and the municipal administration. Firstly, the city councils should reach a status of financial and administrative autonomy within the legal framework. Furthermore, the legislative links pertaining institutional

relations network between the city council, and municipal organization should be set up. Lastly, the city councils engagement should be provided to the strategic planning activities that determined the roadmap that they can follow in the short and long term. Furthermore, the councils' affairs should be taken to the municipalities' annual reports according to their subjects in the aspect of informing the public and the effectiveness of the city councils.

To conclude, a small number of municipalities take account of the city council process, and the majority of the local administrations see this participatory mechanism as a legal obligation and they reach the conclusion that these platforms only 'produce an image' (Çukurçayır and Eroğlu, 2008: 216). Although, democratic achievements are designed with legal regulations; it is obvious that there is a mismatch with the designation and application process. In this participatory process, it is determined that the municipal administration is reluctant, and the level of the awareness of the local institutions is low (Çukurçayır and Eroğlu, 2008: 198). In Turkey, the city councils are in their initial stages but having highly successful local applications; however, it seems that there is a considerable way that the city councils should take at performing their basic functions.

References

Bulut, T. (2013). Şeffaf, katılımcı ve etkin kent yönetimi için kent konseyleri, Bursa: Ekin Yayınevi.

Çukurçayır, M. A. and Eroğlu, H. T. (2008). Kent yönetiminde demokratik bir açılım olarak kent konseyleri, sakarya üniversitesi 1. ulusal yerel yönetimler sempozyumu, 23-24 Ekim 2008, pp. 197-219.

Çukurçayır, M. A. (2011). yerel yönetimler kuram kurum ve yeni yaklaşımlar. Konya: Çizgi Kitabevi.

Emrealp, S. (2010). Kent konseyleri: Türkiye'nin katılımcı demokratik yerel yönetişim modeli olarak dünya'ya armağanı, UCLG-MEWA Yayınları.

Güneş, M. and Eylem, B. (2011). Türkiye'de yerelde yönetişim olanakları, http://iys.inonu.edu.tr/webpanel/dosyalar/1427/file/MuharremGunes.pdf . pp.801-819.

Keskin, E.B., Erbey, N., Odaman, Y. and Tatlı, Y. (2011). Kent konseylerinin yerel demokratik yönetişim mekanizması işlevinin değerlendirilmesi, Kent Konseyleri Sempozyumu Bildiri Kitabı, (Ed. E.B. Keskin), Bursa. pp.307-324.

Keyman, F. (2007). Yerel yönetim reformunda sivil toplumun rolü sempozyumu, sempozyum kitabı, 1.baskı, Tesev Yayınları: İstanbul.

Kutlu, Ö., Usta, S. And Kocaoğlu, M. (2008), "Vatandaş odaklı/vatandaşın olduğu yönetim: kent konseyleri ve Selçuklu belediyesi örneği", Sakarya Üniversitesi 1. Ulusal Yerel Yönetimler Sempozyumu, 23-24 Ekim 2008, pp. 221-235.

Mercer, D. and Benjamin, J. (2000). “Local agenda 21 and barriers to sustainability at the local government level in victoria australia”, Australian Geographer, 31(2), 163-181.

Özdemir, A.T. (2011). Mahalli idarelerde halk katılımı bağlamında kent konseyleri, Sayıştay Dergisi, 13, 31-56.

Özden, S. (2010). Türkiye’de yerel yönetim reformu uygulamasının devamına destek projesi (LAR II AŞAMA), Yerel katılım mekanizmalarının güçlendirilmesi mevcut durum tespit çalışması. http://www.lar.org.tr/uploaded/dosyalar/ cb8d1b7d40fb 8d6751 df908 adde90fb0.pdf. pp1-32.

Savut, E. (2011). Yerel gündem 21 kent konseyleri ve uşak kent konseyi, Kent konseyleri sempozyumu bildiri kitabı, (Ed. E.B. Keskin), Bursa.

Şen, M. (2008). Yerel üzerine aykırı yazılar, 1.baskı, İstanbul: Okutan Yayıncılık.

Şengül, T. (2004). Kent yönetimi ve katılım sorunu, Antakya kent kurultayı (09-11. 12. 2004) bildiriler kitabı, İstanbul: Detay Yayıncılık.

Toprak K., Z. (2011). Kent konseyleri kuruluş felsefesi ve uygulama, Kent Konseyleri Sempozyumu Bildiri Kitabı, (Ed. E.B. Keskin), Bursa. pp. 5-12.

UNCED (United Nations Conference on Environment and Development), (2002). Towards Earth Summit: Stakeholders Involvement, UNCED Briefing Sheet.

UNDP (United Nations Development Program), (2001). Capacity 21, Approaches to Sustainability, LA21 in Turkey: Moving from Local to National. IULA-EMME publications.

The Comparison of Tendency to Risky Behaviour, in Secure/Insecure Attachment in Parents

1.Minoo Pooravari,Corresponding author,
MA in Counseling,Department of Educational Science&Psychology, University of Shahid Beheshti, Tehran ,Iran.

2.Saeed Ghanbari,
Assistant Professor,Department of Educational Science&Psychology, University of Shahid Beheshti, Tehran ,Iran.

3.Ali Zadeh Mohammadi,
Associate Professor, *Family Research Insititute, University of Shahid Beheshti, Tehran, Iran.* Email:

4.Leili Panaghi,
Associate Professor, *Family Research Insititute, University of Shahid Beheshti, Tehran, Iran*. Email:

5.Elham Aghdasta,
MA in Counseling,*Department of Educational Science&Psychology, University ofAllameh Tabataba'ei, Tehran , Iran.*

Abstract

The purpose of present research was comparing tendency to risky behaviours in secure/insecure attachment in parents(mother/father). The Results showed that those showing insecure attachment patterns towards the mother were significantly higher at risk to become cigarette smokers, drug persuasion, and alcohol drinkers compared to those with secure attachment patterns. Those showing insecure attachment patterns towards the father were significantly higher at risk to become cigarette smokers, drug persuasion, compared to those with secure attachment patterns. Referring to the attachment between mother and father, secure attachment to father-insecure attachment to mother depicts the high-risk to become cigarette smokers.By considering the High-risk behavior in term of attachment, this research demonstrates that secure attachment creates an internal working model that provides compatible guidelines while encountering the stressful events.

Keywords:Risky behaviors; Secure/Insecure attachment;Young adults; Parents

1. Introduction

Risky behavior is described as taking part in the activities which expose the individual to a danger. Activities such as excessive alcohol, smoking, illicit drug use and having unprotected sexual intercourse are examples of such activities (McEwan, Hodson & Simmonds, 2012). Risk-taking can also be considered as any voluntary participation of the individual in any behavior possibly leading to negative consequences (Boyer, 2006). It includes behaviors with antisocial or illegal nature or those that are considerably harmful for health (Magar, Phillips & Hosie, 2008). Beyth-Marom & Fischhoff (1997) have defined the risk as the chance of loss and the risk-taking as the predisposition to get involved in the danger (Carr-Gregg, Enderby& Grover, 2003). Risk-taking is applied to the behaviors that potentially can damage the individual or the society and can increase the probability of the negative physical, psychological and social consequences. By introducing the problem behavior syndrome, Jessor (1987) has included smoking, illicit drug abuse, drinking alcohol, reckless driving and immature sexual intercourse as risky behaviors. Diclemente, Hansen &Ponton (1996) added eating disorder, violence and delinquency to that list.

Studies carried out on young adults in Iran, indicate an increase in substance abuse (Rahimi Movaghar,SahimiIzadian & Yoonesian,2006; Sohrabi, Hadian, Daemi, & Asgharnezhad Farid, 2008), taking alcohol (Seradj Zadeh & Feizi, 2007; Rahimi Movaghar et al, 2006; Momen Nasab, Nadjafi, Kaveh & Ahmadpoor, 2006), psychostimulants abuse (Mohtasham Amiri, Khalili Moosavi, Doostdar Sanaye, Jafari Shakib, Poor Soheili, & Mehdipoor, 2009), sexual risk-taking (Momen Nasab et al.2006), smoking cigarettes (Madjidpoor, Hamidzadeh Arbabi, Abbasgholizadeh & Salihi, 2005; Seradj Zadeh, 2007), reckless driving (Baghiani Moghadam, Halvani & Ehrampoosh, 2006; Momen Nasab et al, 2006; Mordadi, Yoonesian & Guilassi, 2007) and violence (Momen Nasab et al, 2006). Every year more adolescents and young people get engaged in such behaviors. Besides, the increase in risky behaviors which is considered a threat to the health of youngsters is the most robust reason to the necessity of understanding the fundamental signals of such increase.

Attachment theory (Bowlby, 1969) has lately been considered as a profound theoretical framework in studying close relationships and individual differences in emotion regulation. It maintains that human has aintrinsic predisposition to build and sustain long-lasting emotional bonds deeply affecting individual's health and survival. Although parent-child relationship is the primary attachment bond during childhood, in adolescence and early adulthood it is gradually replaced with committed romantic relationships, but parents still keep their role as attachment figures throughout life (Hazan & Zeifman, 1999). Attachment styleshave been shown to be one of the main factors that predict the risky behaviors in individuals. Shaver and his colleagues (Shaver & Hazan, 1988; Shaver et al., 1988) have suggested that adult attachment may be related both to the nature of individuals' sexual relationships and their motivations in seeking these relationships. Provided the strong relationships of different manifestations of psychological distress and substance abuse (e.g., Hussong & Chassin, 1994; Kassel, Stroud, & Paronis, 2003), it is reasonable to consider attachment insecurity as a key factor playing a role in the developmental perspective of substance abuse disorders. In a similar way, Walant (1995) maintains that people who have predisposition to alcohol and drug abuse have probably suffered neglect of their attachment needs and try to compensate it by inducing "merger" states using drugs and alcohol. Kohut (1977) has postulated that addiction often originates

when the individual doesn't get or internalize the comforting capacities of the early attachment figures.

Discovering a connection between the attachment and psychopathology has increasingly received interest in recent years (Dozier, Stovall, & Albus, 1999; Van IJzendoorn & Bakermans-Kranenburg,1996).Although mere curiosity can lead to initiation of a risky behavior, the attachment style can influence its continuation (Fathi & Mehrabizadeh, 2008). Despite the fact that few studies have been implemented on attachment and tendency to smoking and illicit drugs abuse, the drug abuse and attachment style seem to be deeply interrelated since both involve emotion regulation and coping strategies as central concepts (Belsky, 2002, Magai, 1999; Newcomb, 1995).

Separation from source of security can be related to his tendency to substance abuse to avoid fears, anxiety and refuge to dreams. Tendency to smoking and substance abuse can be considered as a self-medication against emotional distress. It can also be viewed as an effort to cope with the emotional instability and loss of control. The attachment theory highlights the distinctions between different styles of attachment and how these styles require different types of emotion regulation and coping strategies (Shaver & Mikulincer, 2002).

Attachment styles can influence alcohol abuse and smoking. Insecure attachment is positivly correlated to illicit drugs and alcohol abuse, and smoking. The individuals with insecure attachment style use alcohol, cigarettes and drugs to cope with the stress (Abolghassemi, Mahmoodi & Soleimani, 2009).

Research findings have confirmed higher drinking behaviours rates among the individuals who were born in families lacking intimate parent-child relationships and have not experienced secure bonds (Vungkhanching, Sher, Jackson & Parra, 2004).By studying attachment styles of 212 students in Chicago, Kassel et al (2007) showed that insecure attachment is positively related to the frequency of Marijuana and substance abuse, and smoking. The study of Sisla et al (2004) on 48 individuals with HIV+ indicated that insecure attachment is related to having multiple sexual partners. Brennan&Shaver(1995) found that students with insecure attachment drink alcohol, smoke cigarettes and use substances more than others. They used alcohol and substance, to cope with their stress.

McNally et al. (2003) showed that fearful and preoccupied attachment is related to drinking alcohol. Brennan& Shaver (1995) also indicated that there is a positive relationship between anxious and avoidant attachment style and drinking alcohol to overcome problems, and conversely, there is a negative relationship between secure attachment style and these problems. Findings of Asadi et al (2010) indicated that conflict with mother has a significantly positive relationship with the tendency to smoke. Conflict with father was also positively related to substance abuse. Habibi et al (2011) reported that secure attachment to father and mother has a significant role in segregating students using substances from those who aren't. Nikmanesh et al (2010) found that secure attachment style prevents adolescents from getting engaged in risky behaviors.

Based on what was discussed, young's relationship with their parents which influences their attachment style is one of the factors that can affect perpetration or temptation of risky behaviors in the youth. Just as the separation from mother, when encountered with difficulties, the need for a secure relationship is increased in the individuals and active seeking process is initiated again. In such a situation, if peer group, social sources, or family's source of security is not available or the individual doesn't have the communicational skills required to access such sources, they will inevitably resort to risky behaviors such as smoking, alcohol and substance abuse to relieve

themselves. Due to its rapid effects, such a gratification can introduce a mechanism to these people who are escaping from challenges instead of confronting them, and in the absence of early interventions, it can lead to dependence. Identifying the factors contributing to a person's tendency to risky behaviors is one of the fundamental strategies for prevention from risky behaviors. Current study aims investigate the role of the attachment style in tendency to risky behaviors in a sample of youth in Tehran.

2. Method

The population studied in current research comprised all the single male and female peopleranging between 18 and 30 years old living in Tehran. The sample included 340 of young people chosen by convenient sampling method. The demographic distribution of the population indicated that mean age of the participants was 24.19 (SD = 3.58), 171 (50.3%) of them were female and 169 (SD = 49.7%) were male, 71 people (20.9%) were high school graduate, 39 (11.5%) had an associate diploma, 177 (52.1%) had a Bachelor's degree and 53 (15.5%) had a Master's or higher degree.107 females (62.6%) and 109 males (64.5%) had secure attachment to their mothers and 64 females (37.4%) and 60 males (35.5%) has insecure attachment to their mothers. 70 females (40.9%) and 87 males (51.5%) had secure attachment to their fathers and 101 females (59.1%) and 82 males (48.5%) had insecure attachment to their fathers.

2.1- Data collecting tool

Experience in Close Relationship - Relationship Structure Questionnaire (ECR-RS): This questionnaire was constructed by Fraley et al (2011) to measure the individual differences in any of these four domains: relationships with mother, father, romantic partners, and friends. This questionnaire contains a total of 36 questions and the respondents expressed their opinions on a 7-point Likert scale of 1 to 7 (1 = strongly disagree; 7 = strongly agree). Nine questions are used to assess the attachment in each domain. The questionnaire evaluates the relationship between the two dimensions of anxious and avoidantattachment and based on the scores gained in these two dimensions, we can categorize an individual in any of the four attachment groups: secure, anxious, fearful, preoccupied, and dismissive and determine his/her attachment style (secure or insecure). Cronbach's alpha for each of the dimensions was reported to be 0.89 (Fraley, Heffernan, Vicary & Brumbaugh, 2011).

Youth Risk-taking Scale: This scale was constructed and normalized by Zadeh Mohammadi, Ahmad Abadi, Panaghi & Heidari (2010) and contains 48 items to assess youth's tendency to 6 classes of risky behaviors including violence, reckless driving, smoking, illicit drugs abuse, alcohol use, and sexual risk-taking. The respondents expressed their agreement or disagreement with these items on a 4-point scale from strongly agree to strongly disagree. Cronbach's alpha for the risk-taking scale, reckless driving subscale, violence tendency subscale, smoking tendency subscale, tendency to illicit drugs abuse subscale, tendency to alcohol use subscale, and tendency to sexual risk-taking subscale was 0.93, 0.88, 0.77, 0.91, 0.83, 0.93 and 0.85, respectively.

3. Findings

All data were checked for outliers, skewness,and kurtosis. Low and high outliers wererecoded to 1.5 times the interquartile rangebelow the 25th or above the 75th percentile,respectively.

Mean scores of reckless driving tendency (24.59+/-6.38), violence tendency (14.05+/-4.40), smoking tendency (12.86+/-5.61), tendency to illicit and psychoactive drugs abuse (10.77+/-3.49), tendency to alcohol use (17.89+/-7.76), and tendency to sexual risk-taking (10.13+/-3.91) are presented.
Table 2 shows descriptive indices of risky behaviors in secure/insecure attachment to mother and father.

Results of multivariate ANOVA on tendency to risk-taking behaviours in secure and insecure attachment to mother is presented in the Table 3.

As we can see in table 3, there is a significant difference between secure and insecure attachment styles for the variables smoking (P=0.034), substance abuse (P=0.020) and alcohol use (P=0.045), but the difference between these two groups is not significant for the other variables. According to the previous table, tendency to smoking, substance and psychoactive drugs abuse and alcohol use is higher in insecure than secure group.
Results of multivariate ANOVA on tendency to risk-taking behaviours in secure and insecure attachment to father is presented in the Table 4.

As we see in Table 6, there is a significant difference between secure and insecure attachment styles for the variables smoking (P=0.041) and substance abuse (P=0.029), but the difference between these two groups is not significant for the other variables. According to the table5, tendency to smoking and substance and psychoactive drugs abuse is higher in insecure than secure group.
Mean score and standard deviation related to subscales of the risky behaviors in secure/insecure attachment to parents are presented in Table 5.

Put Table 5 here

Table 6 presents the multivariate ANOVA results on tendency to risk-taking behaviors in secure and insecure attachment to parents.

As we can see in Table 6, there is a significant difference between secure and insecure attachment styles for the variables smoking (P=0.01), but the difference between these two groups is not significant for the other variables.

Put Table 6 here

Put figure 1 here

Accordingto the figure 1, when individual's attachment to their father is secure, but to mother is insecure, the tendency to smoking is higher. But when the attachment to father is insecure, and to mother is either secure or insecure, or when the attachment to both of the parents is secure, there's no significant difference between them.

4. Discussion

As we saw in findings section, the tendency to risky behaviors such as smoking, drug abuse and taking psychoactive drugs and alcohol use are higher in maternal insecure attachment than secure attachment. This result is consistent with the findings of Habibi et al. (2011), Asadi et al. (2010), Abolghasemi et al. (2009), kassel et al (2007), McNally et al (2003), Bernan & shaver (1995).

According to the attachment approach, the quality of mother-child relationship and the how well mother tries and cares to form a secure relationship has a key role in taking a positive point of view to other significant relationships and how one reacts to difficult situations of life. Secure attachment is related to proper and flexible adjustment to the emotional experiences and tolerating stressors. On the contrary, strategies of the insecure people to overcome negative emotions and situations is located in a spectrum of attempts to maximize or minimize attachment needs. Both of these strategies may expose the person to further danger and vulnerability and the risk of self-destructive behaviors and predispose insecure people to perpetrate risky behaviors (Blesky, 2002). Individuals with insecure attachment resort to other ways of self-regulating themselves, e. g. drinking, substance abuse, and smoking. Then, emotion-based coping strategies can be used as a mechanism influencing the severity of substance abuse, smoking, and alcohol to explain the results. In case people with secure attachment style seek social support when confronting emotional stresses, it probably explains avoidance of the secure people from taking illicit drugs and smoking. Research has confirmed that drinking alcohol is a strategy to overcome negative emotions. One of the first outcomes of the attachment in the adults is regulating their emotions. Those who are unable to manage and suppress their negative emotions in their interpersonal relationships are more likely to use alcohol as a maladjustive way of reducing stress (McNally et al, 2003). People with dependence on substance and smoking suffer from painful childhood experiences related to severe disencouragement of their parents, especially their mothers, and so, they get dependent on external

issues and objects and smoking and taking drugs becomes one of the compensation strategies they employ later in life (Abolghasemi et al, 2009).

As we saw in findings section, the tendency to risky behaviors such as smoking, drug abuse and taking psychoactive drugs are higher in paternal insecure attachment than secure attachment. This result is consistent with the findings of Habibi et al. (2011), Asadi et al. (2010), Beyers et al. (2004), Nikmanesh et al. (2010), Abolghasemi et al. (2009),Kassele et al. (2007). To explain such a finding we can claim that there is a positive relationship between performance and integrity of the family, parent-child relationship quality, and interactions among family members and reducing their external problems. In fact, integrity level of the family, parent-child relationship and monitoring quality are key protective factors against external behavioral problems of the family members, especially adolescents (Romero & Ruiz, 2007) and since mothers cannot manage to monitor and take care of the adolescents and young children alone and doesn't show required competence (Khodadadi, Ahmadi, Molazemani & Albukordi, 2012), high parental monitoring, especially paternal role and the positive performance of the family is correlated with lower rates of relationship with delinquent peers and risky behavior perpetration and these two factors determine lower probability of risk-taking behavior.

Insecure attachment styles pave the way for youmg adult's drug abuse and smoking by creating psychological disturbances. Tendency to drug abuse and smoking can be considered as some kind of self-medication against problems and emotional disturbances. They can also be considered as an attempt to cope with the emotional instability and loss of control. Probably, the lack of appropriate interaction between father and child, father's negligence to child's emotional needs during adolescence and young age, lack of trust between father and the child, and big distance between father and the child, lack of empathy in stressful issues and inability of the parents, especially fathers in expressing their reasonable feelings, all contribute to propelling the individual to drug abuse and smoking. Drug abuse leads the individual to the discovery that he/she is able to control and relieve his/her anguish from failure and frustration in securing relationship and change his/her morale.

As we saw in the findings section, the difference between father and mother is only significant in smoking, which means that if the attachment to father is secure and the attachment to mother is insecure, tendency to smoking is higher.

Among familial factors, parents' monitoring has been known as a main source of the tendency to commit risky behaviors. Higher modeling effect from father, closer and more intimate relationship with the father, forming coalition and triangling in the family, mother's poor influence and lower power on others' behaviors (poor maternal authority), tendency to authoritarian mother-child relationship, and permissive style in father-child relationship are some of the familial factors that reinforce tendency to masculine behaviors. So, considering smoking as a masculine behavior and as a one that can be suggestive of being grown-up and independent, tendency to smoking will continue if the familial background is ready.

On the other hand, the individual is absorbed from family into the society and relationships with the peers become important. Negligence in parental responsibilities is one of the factors facilitating adolescents' company with the delinquent peers and perpetrating risky behaviors (Eiton, Crooger, Johnson, MacGu & Lacono, 2009). Then, in explaining this finding which is consistent with the finding of Beck et al (2003) we can point out that this difference is related to family and social background, positivism to low dangers of this behavior, lower social ostracism, prevalence of

the parents who smoke and ease of accessing cigarettes. People perceive much less danger in smoking than the other risky behaviors such as drug abuse and sexual relationships and many parents might have experienced it. That is why it seems logical that in the other behaviors, there is not a significant difference between these two groups.

In comparing fathers and mothers, we can also mention that secure attachment to the mother creates a safety and peace of mind in physiological level and in stress. Hence, that mother, as the main attachment figure can act as a secure base for the child who provides security and comfort for the child when threatened or stressed out. Getting separated from the source of the security can be related with the disconnection of the individual from human resources around him/her and tendency to use drugs and smoke to escape from fears and anxieties. In reverse, father provides security in monitoring and regulating emotions by being sensitive to the child when playing and supporting him/her when his/her discovering system is activated (Cassidy & shaver, 2008). A people whose attachment figure (mother) has not been available and responsive in stressful situations and has developed an insecure attachment style uses smoking as a maladjustive method to reduce stress.

Moreover, in explaining the insignificant relationship of the insecure attachment style and violence we can mention that most of the questions related to the violence implied physical violence and verbal violence was not covered. Besides, those who have high anxious attachment are not able to overcome their stress and problems, and then, have high motivation to keep their relationship with the others and avoiding being rejected by the others. Since these people care about the others more than themselves, when they are angry, they project their agression directly to themselves instead of others. A lot of research studies have demonstrated the relationship between anxious attachment and suicide (Groomley & MacNeil, 2010).

There wasn't a significant relationship between the attachment and tendency to reckless driving. To explain, it can be mentioed that immediate rewards or punishments are more effective than delayed ones. Smoking, drinking alcohol, and drug abuse have immediate effects (sedation, painkilling, etc) and their negative consequences (addiction, addiction-related diseases such as AIDS) are disclosed later and youth are more likely to be involved in these behaviors due to their instantaneous pleasure and delayed, whereas the negative consequences of reckless driving, such as accidents, injury and getting fined are immediate and can modificate youth' risk-taking behavior.

Tendency to agression, reckless driving and risky sexual behaviors are also related more with sensation seeking of the individual than an emotion-regulation or sress-reducing strategy and might not be much related with the attachment style.

Current study compared tendency to risky behaviors in secure/insecure attachment to parents. Resuls indicated that generally, Tehranian young adults' risk-taking behavior is in alarming state. Regarding the effectiveness of the attachment style, the results suggested that secure attachment with significant figures of life is important in regulating emotions and affections. Secure attachment through the adjusted and adaptive strategies can provide proper emotional relationships and lead to well-being, but insecure attachment through maladjustive and maladaptive emotional and affective strategies can propel the individual to employ maladjustive methods such as alcohol, smoking or taking drugs when confronting pressure and life stresses to alleviate himself/herself. Although effectively relieving, this strategy is a self-destructive way for the individual.

Table 1. Mean, standard deviation and range for risk-taking behavior components

	Risky Driving	Violance	smoking	illicit drugs abuse	Alcohol	sexual risk-taking
Mean	24.59	14.05	12.86	10.77	17.89	10.13
S.D	6.38	4.40	5.61	3.49	7.76	3.91
Min	10	8	8	9	9	7
Max	40	28	30	32	36	27

Table 2. Descriptive indices of risky behaviors in secure/insecure attachment to mother and father

	Group	Mean	S.D
Risky driving	Secure to mother	24.10	6.23
	Insecure to mother	24.26	6.08
	Secure to father	24.17	5.98
	Insecure to father	24.15	6.37
Violance	Secure to mother	13.79	4.13
	Insecure to mother	13.86	4.33
	Secure to father	13.79	4.15
	Insecure to father	13.99	4.33
smoking	Secure to mother	12.03	5.13
	Insecure to mother	14.10	5.70
	Secure to father	12.43	5.39
	Insecure to father	15.19	5.16
illicit drugs abuse	Secure to mother	9.91	1.73
	Insecure to mother	12.27	1.94
	Secure to father	10.05	1.85
	Insecure to father	13.07	1.82
Alcohol	Secure to mother	16.53	7.70
	Insecure to mother	18.32	6.90
	Secure to father	16.93	7.20
	Insecure to father	17.34	7.70
sexual risk-taking	Secure to mother	9.56	3.06
	Insecure to mother	9.53	3.24
	Secure to father	9.62	3.03
	Insecure to father	9.54	2.97

Table 3. Multivariate ANOVA on tendency to risk-taking behaviours in secure and insecure attachment to mother

		Sum of squere	df	Mean square	F	Sig.
risky driving	Between group	1.93	1	1.93	0.051	0.822
	error	11650.142	305	38.197		
violance	Between group	0.292	1	0.292	0.017	0.898
	error	5380.124	305	17.640		
smoking	Between group	79.115	1	79.115	2.786	0.034*
	error	8662.605	305	28.402		
substance abuse	Between group	8.745	1	8.745	2.686	0.020*
	error	992.929	305	3.256		
alcohol	Between group	101.293	1	101.293	1.834	0.045*
	error	16847.248	305	55.237		
sexual risk-taking	Between group	0.470	1	0.470	0.005	0.126
	error	2975.920	305	9.757		

P< 0.05

Table 4. Multivariate ANOVA on tendency to risk-taking behaviours in secure and insecure attachment to father

		Sum of squere	df	Mean square	F	Sig.
risky driving	Between group	0.056	1	0.056	0.001	0.970
	error	11.73.379	290	38.184		
violance	Between group	2.748	1	2.748	0.153	0.696
	error	5218.522	290	17.995		
smoking	Between group	4.228	1	4.228	0.152	0.041*
	error	8078.412	290	27.857		
substance abuse	Between group	0.038	1	0.038	0.011	0.029*
	error	975.972	290	3.365		
alcohol	Between group	11.998	1	11.998	0.216	0.643
	error	16114.522	290	55.567		

sexual risk-taking	Between group	0.054	1	0.054	0.054	0.816
	error	2862.491	290	9.871		

P<0.05

Table 5. Descriptive indices of risky behaviors in secure/insecure attachment to parent

	Mother	Father	Mean	S.D
Risky driving	secure	secure	24.03	6.18
		insecure	24.52	6.27
	insecure	secure	24.86	5.23
		insecure	23.92	6.44
Violance	secure	secure	13.76	4.28
		insecure	14.13	3.97
	insecure	secure	14.03	3.68
		insecure	13.92	4.68
smoking	secure	secure	11.82	4.96
		insecure	12.25	5.39
	insecure	secure	15.03	4.42
		insecure	12.18	4.96
illicit drugs abuse	secure	secure	9.88	1.79
		insecure	10.01	1.69
	insecure	secure	10.76	1.98
		insecure	10.14	1.96
Alcohol	secure	secure	17.39	7.78
		insecure	18.13	7.69
	insecure	secure	17.28	7.54
		insecure	15.85	6.51
sexual risk-taking	secure	secure	9.48	3.08
		insecure	9.93	3.11
	insecure	secure	10.28	4.13
		insecure	9.18	2.79

Table 6. Multivariate ANOVA on tendency to risk-taking behaviours in secure and insecure attachment to father

		Sum of squere	df	Mean square	F	Sig.
risky driving	Between group	29.28	1	29.28	766	.38
	error	10935.58	286	38.23		
violance	Between group	3.26	1	3.26	180	.67
	error	5175.73	286	18.09		
smoking	Between group	151.54	1	151.54	5.55	.01*
	error	7808.31	286	27.30		
substance abuse	Between group	7.91	1	7.91	2.37	0.12
	error	955.24	286	3.34		
alcohol	Between group	65.82	1	65.82	1.19	0.28
	error	15837.38	286	55.37		
sexual risk-taking	Between group	33.52	1	33.52	3.40	0.06
	error	2818.76	286	9.85		

P<0.

Figure 1: tendency to smoking in attachment to parent

Refrences:

Abolghasemi, A., Mahmoodi, H., Soleimani, E. (2009). The role of attachment styles and defense mechanisms in discriminating cigarette smoker students from non-smokers. *Quarterly Journal of Sabzevar University of Medical Sciences, 16 (3):*134-141.

Asadi Yoonesi, M., Ebrahimi, H., Shokri, M. & Shadman, M. (2010). The relationship of conflict with parents and attitude to smoking with cigarette usage, A selection of 30 provincial congresses, Preliminary prevention from addiction.

Beck, K. H, Boyle, J. R., & Boekeloo, B. O. (2003). Parental monitoring and adolescent alcohol risk in a clinic population. *American journal of health behavior, 27*(2), 108-115.

Belsky, J. (2002). Developmental origins of attachment styles. *Attachment & human development, 4*(2), 166-170.

Beyers, J. M, Toumbourou, J. W, Catalano, R. F, A., Michael W, & Hawkins, J D. (2004). A cross-national comparison of risk and protective factors for adolescent substance use: the United States and Australia. *Journal of Adolescent Health, 35*(1), 3-16.

Beyth-Marom, R., & Fischhoff, B. (1997). Adolescents' decisions about risks: A cognitive perspective. *Health risks and developmental transitions during adolescence*, 110-135.

Bowlby, J. (1969). Attachment and loss. Vol. 1: Attachment. New York: Basic Books.

Boyer, Ty W. (2006). The development of risk-taking: A multi-perspective review. *Developmental Review, 26*(3), 291-345.

Brennan, K. A., & Shaver, P. R. (1995). Dimensions of adult attachment, affect regulation, and romantic relationship functioning. *Personality and Social Psychology Bulletin, 21*(3), 267-283.

Brennan, K. A.& Shaver, P. R. (1995). Dimensions of adult attachment, affect regulation, and romantic relationship functioning. *Personality and Social Psychology Bulletin, 21*(3), 267-283.

Carr-Gregg, M. RC, Enderby, K. C, & Grover, S. R. (2003). Risk-taking behaviour of young women in Australia: screening for health-risk behaviors. *Medical journal of Australia, 178*(12), 601-606.

Cassidy, J., & Shaver, P. R. (2008). *Handbook of attachment: Theory, research, and clinical applications*: Guilford Press.

Cassidy, J.& Shaver, P. R. (2008). *Handbook of attachment: Theory, research, and clinical applications*: Guilford Press.

Ciesla, J. A, Roberts, J. E, & Hewitt, R. G. (2004). Adult Attachment and High-Risk Sexual Behavior Among HIV-Positive Patients. *Journal of Applied Social Psychology, 34*(1), 108-124.

DiClemente, R.J, Hansen, W. B, & Ponton, L. E. (1996). *Handbook of adolescent health risk behavior*: Springer.

Eaton, N. R, Krueger, R. F, Johnson, W., McGue, M., & Iacono, W. G. (2009). Parental monitoring, personality, and delinquency: Further support for a reconceptualization of monitoring. *Journal of research in personality, 43*(1), 49-59.

Fathi, K., Mehrabi Zadeh, M. (2008). Depression, sensation seeking, aggression, attachment styles and parental education as a predictor of drug dependence in adolescents in Ahwaz. *Journal of Education and Psychology Studies. 9(2), 23-45*

Fraley, R. C., Heffernan, M. E, Vicary, A. M., & Brumbaugh, C. C. (2011). The experiences in close relationships—Relationship Structures Questionnaire: A method for assessing attachment orientations across relationships. *Psychological assessment, 23*(3), 615.

Gormley, B., & McNiel, D. E. (2010). Adult attachment orientations, depressive symptoms, anger, and self-directed aggression by psychiatric patients. *Cognitive therapy and research, 34*(3), 272-281.

Habibi, M., Besharat, M., Bahrami, H., Rostami, R., Ferer, L. (2011). Predict substance use in adolescents based on risk indicators and preventive protection of individual, family, peers and Location. *Journal of Clinical Psychology, 4(1), 43-54.*

Jessor, R. (1987). Problem-behavior theory, psychosocial development, and adolescent problem drinking. *British journal of addiction, 82*(4), 331-342.

Kassel, J. D., Wardle, M., & Roberts, J. E. (2007). Adult attachment security and college student substance use. *Addictive behaviors, 32*(6), 1164-1176.

Khodadadi, J., Ahmadi, Kh., Molazemani, A., & Albookordi, S. (2012). Epidemiology of risky behaviors in adolescent girls and boys in army families, *Journal of Military Psychology, 29, 3:* 19-28.

Madjidpoor, A., Hamidzadeh Arbabi, Y., Abbasgholizadeh, N. & Salehi, E. (2007). Prevalence and Causes of Tendency to Cigarette Smoking among Students in Ardabil University of Medical Sciences. *Science research journal of Ardabil University of Medical Sciences*, *5, 3,* 266-270.

Magar, E. CE., Phillips, L. H.& Hosie, J. A. (2008). Self-regulation and risk-taking. *Personality and individual differences, 45*(2), 153-159.

Mc Ewan, Felicity A, Hodson, Margaret E, & Simmonds, Nicholas J. (2012). The prevalence of "risky behaviour" in adults with cystic fibrosis. *Journal of Cystic Fibrosis, 11*(1), 56-58.

McNally, A. M, Palfai, T. P, Levine, R. V, & Moore, B. M. (2003). Attachment dimensions and drinking-related problems among young adults: The mediational role of coping motives. *Addictive behaviors, 28*(6), 1115-1127.

Mohtasham Amiri , Z., Khalili Moosavi, A., Doostdar- Sanaye, M., Jafari Shakib, A., Poor Soheily, Z., Mahdi Poor, M. (2009). Ecstasy use among college students in northern Iran. *Journal ofPayesh quarterly, 8(4),* 335-341.

Mo'men Nasab, M., Nadjafi, S., Kaveh, M. & Ahmadpoor, F. (2006). Investigating prevalence of the health-related risky behaviors in the students of Educational Centers of Alishahr in Khorram Abad in 1383-1384. *Journal of Yafteh quarterly, 8(2),* 23-29.

Mordadi, A., Yoonesian, M. & Gillasi, H. (2007). Risk factors for motorcyclist traffic accidents in Kashan. Journal *of Health and Health-related research Institute, 5, 1,* 57-68.

Nikmanesh, Z., Khosravi, Z., Bani Jamali, Sh., Kazemi, Y. (2010). Qualitative investigation of some risk-factors affecting students' behavior, *Abstracts of the 3rd Congress for the National Family Pathology,* Shahid Beheshti University.

Rahimi Movaghar, A., Sahimi Izadian, E., & Yoonesian, M. (2006). A review on substance abuse in university students. *Journal of Payesh Quarterly, 5 (2),* 83-104.

Romero, A. J, & Ruiz, M. (2007). Does familism lead to increased parental monitoring?: Protective factors for coping with risky behaviors. *Journal of Child and Family Studies, 16*(2), 143-154.

Seraj Zadeh, H. & Feizi, (2007). Investigating substance and alcohol abuse in the students: a survey in governmental universities under the supervision of Science Ministry in 1381-1382. *Journal of Refah Ejtema'ei, 2,* 85-110.

Shaver, P. R, & Mikulincer, M. (2002). Attachment-related psychodynamics. *Attachment & human development, 4*(2), 133-161.

Sohrabi, F., Hadian, M, Da'emi, H. & Asgharnezhad Farid, A. (2008). The effectiveness of healthy behavior training program in changing attitude of students towards substance abuse. *Journal of Behavioral Sciences*, *Vol 2, No. 3,* 209-220.

Vungkhanching, M., Sher, K. J., Jackson, K. M., & Parra, G. R. (2004). Relation of attachment style to family history of alcoholism and alcohol use disorders in early adulthood. *Journal of* Drug and Alcohol Dependence, 75, 47–53.

Zadeh Mohammadi, A., Ahmad Abadi, Z., Panaghi. L. & Heidari., M.(2010). Validity and Reliability of Iranian Youth Risk-Taking Scale. *Journal of Psychology. 15(2). 129-146.*

The end of natural water scarcity

Luis Antonio Bittar Venturi

Author information

Associate Professor in Physical Geography at the Departmnent of Geography - University of São Paulo – Brazil.

Corresponding author

Department of Geography – University of São Paulo

Avenida Prof. Lineu Prestes, 338 Cidade Universitária

São Paulo – SP CEP 05508-000

Sponsoring information

This study was sponsored by FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo).

Abstract

It has been widely proposed that water scarcity is unavoidable and may or not lead to conflicts. Most authors jump directly to the consequences of a supposed idea of water scarcity. Here, we reject this hypothesis through two arguments. Firstly, we remind that fresh water stocks are fed by oceans, hence, it is incongruous think about water scarcity. Secondly, we demonstrate that presently, humankind is able to produce freshwater in industrial rhythm, leading to a total independence of groundwater. Using a 12-year dataset of water production in Dubai, we show that production of freshwater from desalination plants and from groundwater sources grows inversely indicating that this latter is irrelevant to water supply and its contribution will soon be annulled. We then conclude that water must be conceived not only as 'inexhaustible', but also as a 'producible' resource.

Keywords

Water, scarcity, desalination, inexhaustible

I Background and introduction

The threat of water scarcity has been widely emphasised by scientists, politicians and the mass media. For many years, most scientific articles on this subject have suggested that water scarcity will cause conflicts in the future. This idea is known as the 'water-war hypothesis'. Gleick (1993), Homer-Dixon (1999), Ohlsson (1999) and Berman & Wihbey (1999) have all stressed this possibility. The last authors, referring to the Middle-East, claimed that nations would be sliding toward conflict over water. In addition to academic experts, political authorities, including three UN Secretaries-Generals, have strongly warned of conflicts due to water scarcity. According to Katz (2011) Boutros Boutros-Ghali, the UN Secretary-General from 1992 until 1996, asserted that "*The next war in the Middle East will be over water*". His successor, Kofi Annan, who was Secretary-General from 1997 until 2006, echoed this assertion in 2001: *"Fierce competition for freshwater may well become a source of conflict and wars in the future"*. The current UN Secretary-General, Ban Ki-Moon, has also emphasised that *"Water scarcity has created a high risk of violent conflict"*.

However, other scholars have disagreed with the water-war hypothesis; they argue that this prediction has been artificially created in response to various interests and that the prediction has no empirical foundation. These authors include Klare (2001), Simon (1980), Singer (1987), Rebouças (2004) and Katz (2011), who argue adamantly against the hypothesis. Based on the lack of empirical evidence for wars over water, Katz (op cit) severely criticises the proponents of the water-war hypothesis:

> *"By tying their primary cause to conflict over water, actors increase their visibility and offer those who sympathize with their mission an additional reason to offer support or take action. […] Increasing the severity of their messages is one tactic to attract attention […]. Doing so increases the potential to gain access to policy-makers and the media […] and] also expands possibilities for further research collaboration."*

Nevertheless, within the context of this discussion about whether water scarcity will cause conflicts, studies questioning water scarcity itself are lacking. Water scarcity appears to have been universally accepted among scientists and politicians as a Malthusian paradigm in which technical developments are not adequately considered. Because the inevitability of water scarcity is universally believed, most writers skip directly to its consequences and barely address the issue of scarcity itself. The present article aims to fill this gap by demonstrating that natural water scarcity will soon no longer be a problem.

First, we demonstrate that it is not reasonable to consider water scarcity on a global scale because this resource is one of the most abundant on Earth and because the hydrological cycle will persist as long as natural forces, such as gravity, solar energy and the rotation of the earth, remain in effect. Thus, we can reasonably consider water scarcity only on regional or local scales. We then distinguish natural and social water scarcity and make evident that in many regions, the lack of access to water is due to mismanagement rather than natural scarcity.

Given these premises, we then selected a regional context to provide an empirical example to the analysis of a decreasing dependence on natural groundwater sources. We analysed a 12-year water-production dataset from emirate of Dubai comparing water production with demand, and quantifying the proportion of the total water production that is derived from

ground sources and the proportion that is derived from desalination. The results made evident that in Dubai, increasing use of desalination technology is leading toward complete independence from groundwater sources, which would definitively end natural water scarcity. The same trend is occurring in other countries of the Arabian Peninsula, such as Saudi Arabia, Bahrain, Kuwait and Qatar. However, we focused on Dubai because our aim is simply to demonstrate that water scarcity is ending in some regions, and we did not intend to quantify the extent to which this process is occurring. We also showed that energy costs and demand have decreased considerably in the past decade, thereby indicating that desalination could soon be widely employed in densely populated arid regions throughout the world. New technologies have reduced the amount of petroleum and gas required, and new materials and techniques have been incorporated into the desalination process; both types of changes have made the desalination process more efficient and less expensive.

Assuming that desalinated water can be produced at a large scale, we conclude by proposing a conceptual adjustment: rather than merely a renewable natural resource, water should be considered a producible resource similar to those produced through agriculture and mining.

II Theoretical development of the general framework

1 *A water planet with some dry regions*

Any discussion of water must consider the global scale, including the oceans. Although ocean water is not immediately available for human consumption, it represents the greatest natural source of water, and it will indefinitely replenish continental freshwater stocks through natural hydrological processes, such as evaporation and precipitation. Worldwide, the land surface receives approximately 40,865 cubic kilometres of meteoric water (primarily rain, sleet

and snow) each year (Camp, 2009, p. 162). Mauser shows figures much higher: 110km3 of precipitation per year just over continents (2009, p.7).

In contrast, if we adopt a fragmentary approach that considers only continental freshwater, we must assume that all rivers 'die' when they reach the ocean. Thus, the Amazon River alone 'destroys' more than 200,000 cubic metres of freshwater per second at its mouth. Therefore, it is incongruous to treat freshwater and saltwater separately. Given this, it is unreasonable to consider global water scarcity because water is the one of the most abundant natural resource on our planet by far. Because the quantity of water that exists on Earth (approximately 1.4 billion cubic kilometres, according to Camp, 2009, p.160) is so much greater than the amount that is used by humankind, water can be considered an inexhaustible natural resource. It is unthinkable that global water stocks could be dangerously reduced, much less depleted. Furthermore, an immense quantity of freshwater is stored at the poles (23.8 million km^3, or 68.9% of all freshwater on Earth). Even when one considers only the meteoric water that comes from the atmosphere, the global depletion of water stocks is highly improbable, given the quantities cited above. Camp (2009, p.162) has asserted that *"[…] of that amount, about 588 cubic miles* [approximately 2,451 cubic kilometres] *of meteoric water falls in the United States each year [...]. We use about 19 percent of our potential water supply and almost 81 percent continues in the hydrologic cycle"*. Virtually all water that is withdrawn from the hydrological cycle by human activities will eventually return. Consequently, "*almost any use is temporary, so 'borrowed' might be a more accurate description of what happens to water"*.

Although the quantity of freshwater exceeds human needs on a global scale, many regions of the Earth's surface exhibit natural water scarcity. Regionally, water scarcity is caused by complex natural processes, especially climatic variables, such as low precipitation. But would people facing scarcity be a natural matter?

2 *Scarcity of planning and management*

We can easily identify regions or localities where natural water scarcity may cause severe challenges for human inhabitants. Such regions include northeast Brazil, northern Africa, the Arabian Peninsula and the southwest coast of the United States. Whether people are affected by water scarcity and live under harsh conditions is thus primarily a social matter rather than a natural one, and it has historical, political and management dimensions.

The historical dimension refers to the decision to settle in a given arid region that was made at some time in the past. Nature or climate cannot be blamed for the water scarcity that people face, although such mistaken blame is often exhibited in the media and among local government officials.

The political dimension is exemplified by northeast Brazil. Water scarcity can be generated or made worse by political inequality, such as when local politicians assure powerful farmers that they will have first access to the scarce water supply, thereby making poor people vulnerable to political bargaining.

The management dimension is perhaps the most important for explaining water scarcity because there is no other reasonable explanation for the high frequency of water-borne diseases in children in highly humid regions such as the Amazon River basin. Similarly, there is no other reason for periodic water rationing in highly humid and economically prosperous areas, such as the São Paulo and Curitiba metropolitan regions in Brazil. Rebouças (2003) has explained these contradictions in his article *"O Paradoxo Brasileiro"* (The Brazilian Paradox). He argues that these problems are due to mismanagement, which results in inadequate water treatment and distribution (in the Amazon) or overexploitation and inefficiency combined with leakage and fraud (in São Paulo and Curitiba). According to official data from SABESP (2012), the Sanitation Company of São Paulo State, 25.7% of all water produced in 2012 was lost through either leakage (65% of losses) or clandestine appropriation and fraud (35% of losses). Despite

the inefficiency that these figures indicate, the average water loss in Brazil is even greater: according to official data from SNIS (2010), the National Sanitation Information System, approximately 35.9% of all treated water was lost in 2010.

At the opposite extreme, how can we explain the satisfactory water supply enjoyed by human populations in some highly arid regions, such as the Arabian Peninsula? Again, management is the primary explanation: in this case, effective management prioritises water production and distribution projects. In this region, water has been scarce since the beginning of human settlement. Therefore, effective water management has historically been a high priority, and ancient and modern systems coexist in some areas. In the Sultanate of Oman, for example, modern desalination plants, such as that in Sur, can produce 80,000 m^3/day (for a medium-size plant) to supply urban areas (Sur Desalination Plant, 2012), whereas 4,112 *aflaj*, an ancient system of canals that are partly covered to avoid evaporation, deliver water from the highlands to rural areas in the plains by means of gravity (Ministry of Information, 2010, p.221). Furthermore, numerous wells are spread across Oman and throughout the MENA region (Middle East and North Africa). Therefore, an adequate water supply requires not only solid financial support but also adaptability to natural conditions.

As a partial conclusion, natural water scarcity does not exist on a global scale, and water scarcity is a social rather than a natural phenomenon on regional and local scales. Therefore, solutions will always depend on political decisions that promote more efficient water management, including the planning of human settlements. In other words, water reserves are fixed, whereas humankind is flexible and capable of decision-making. Thus, humans bear the sole responsibility for whether they are affected by water scarcity.

III The Study Case and Methods

1 *Arabian Peninsula – the ocean leakage*

The Arabian Peninsula is one of the driest regions on Earth. Some countries there (e.g., Saudi Arabia, Yemen and Oman) have less than 500 m³ of water per inhabitant per year, and others (e.g., UAE, Qatar, Bahrain and Kuwait) must rely on less than 100 m³ per inhabitant per year (Smith, 2008, p.132-133). Nevertheless, these countries have proved that natural water scarcity need not be an obstacle to development but rather can be overcome through investment and technology. Today, some of these countries have nearly achieved total independence from groundwater sources and weather patterns.

Here, we focus on the emirate of Dubai, which is one of the seven emirates within the United Arab Emirates. Over a 12-year period, this emirate has exhibited significantly increasing water demand and production and decreasing groundwater use, as illustrated in figure 1.

Figure 1. Water production in Dubai, 2001 through 2012. Data obtained from http://www.dewa.gov.ae/aboutus/waterStats2011.aspx.

According to DEWA (2013), the Dubai Electricity and Water Administration, water production doubled over this period (increasing by 101,5%) and reached 96,380 MIG (millions of imperial gallons) in 2012. This quantity is equivalent to 412,745,123.5 m^3 of water, which is an impressive 1,13 million m^3/day. During the same period, the number of consumers increased by 191,5% and reached 554,985 in 2012, as shown in figure 2.

Figure 2. Number of water consumers in Dubai, 2001 through 2012. Data obtained from http://www.dewa.gov.ae/aboutus/waterStats2011.aspx.

Although the increases in water production and demand exhibit a strong statistical

correlation (0,959), it initially appears that water production has lagged demand because the number of consumers has increased faster than the total water production. However, merging these two datasets yields a third metric, the evolution in *per capita* water availability, which better reflects water deficits or surpluses.

Figure 3. *Per capita* water availability in Dubai, 2001 through 2012. Data obtained from http://www.dewa.gov.ae/aboutus/waterStats2011.aspx.

Indeed, the figure 3 shows a gradual decline in *per capita* water availability over the 12-year period. If the number of consumers is increasing faster than water production, we might infer that Dubai will inevitably suffer from water scarcity in the future. However, the emirate has been able to provide more than 1,000 m^3 of water per person (1,048.35 m^3/person/year on average), thereby maintaining a comfortable surplus despite the increasing demand, as shown in figure 4.

Figure 4. Annual surplus water production in Dubai, 2001 through 2012. Data obtained from http://www.dewa.gov.ae/aboutus/waterStats2011.aspx.

On average, the water surplus was approximately 12% during this period. This percentage is clearly significant when one considers that the natural availability is less than 100 m^3 of water per inhabitant per year. The average availability of more than 1.000 m^3 of water per inhabitant per year is similar to that of Denmark (1.128 m^3 per inhabitant per year) and South Africa (1.154 m per inhabitant per year), according to Smith (2008, p.132). Therefore, we conclude that water scarcity has been effectively eliminated in Dubai.

Comparing the amount of water produced by desalination systems with that obtained from groundwater sources, we will now demonstrate that groundwater will not be required in the near future.

The figure 5 reveals a clear and increasing preponderance of desalinated water and a decreasing reliance on groundwater.

Figure 5. Contributions of desalination and groundwater to total water production in Dubai, 2001 through 2012. Data obtained from http://www.dewa.gov.ae/aboutus/waterStats2011.aspx.

In 2005, 99.29% of all water consumed in Dubai came from desalination plants. Although groundwater production increased briefly (reaching 4.49% in 2010), these sources appear to have been largely exhausted. Although the contribution of groundwater varied somewhat over the last 5 years of this dataset, it decreased by 79.1% overall within the study period. Because of a lack of data, we cannot statistically predict precisely when groundwater will cease to contribute to water production. Nevertheless, a tendency toward the elimination of groundwater sources is evident. When this event occurs (most likely within a few years), the human population of Dubai will have achieved complete independence from groundwater sources.

IV Perspectives

According to data from the IDA (2013a), the total global desalination capacity in 2011 was 66.5 million cubic meters per day. This capacity was provided by 16,000 thousand plants distributed among 150 countries. This desalinated water completely or partially supplies the needs of approximately 300 million people. Although these figures appear large, they are likely to increase rapidly once desalination technology becomes more efficient and inexpensive. Patricia A. Burke, the IDA Secretary General, has said that

> *"The desalination industry has done much to lower the cost of desalination by developing technologies that lower energy*

requirements, implementing practices that achieve greater operational efficiency and adopting measures to enhance environmental stewardship".(IDA, 2013b)

For example, the energy required for the RO (reverse osmosis) process has been reduced significantly at the Sharqiyah Desalination Plant in Sur, which is a coastal city in Oman. According to Michel Morillon (2012, *pers. comm.*, 30th May), the engineer charged for the Sur Plant construction, if it was required, ten years ago, 15 kW (kilowatts) to produce 1 m^3 of fresh water, only 3.5 kW is needed to produce the same m^3 today. Thus, production is approaching the minimum limit of 2.5 kW per m^3 of freshwater. This reduction has been achieved through technical solutions and new procedures. For example, pumping water from 80-m-deep beachwells rather than directly from the ocean can eliminate the need for a first filtering because the well water is of higher quality, with low turbidity and silt density. Another method to optimise energy use is the Energy Recovery Device, which recovers mechanical energy from the extremely high density of the wastewater (brine), thus reducing the energy required to produce each m^3 of freshwater by as much as 40% compared with conventional plants.

In addition to these relatively simple technical procedures, more sophisticated desalination techniques have been developed and gradually introduced. To date, RO and MSF (the Multi-Stage Flash thermal process) account for 60% and 26% of the installed desalination capacity, respectively. Today, however, new technologies promise increased filtration efficiency and, consequently, reduced energy demand. According to Goh and Ismail (2013) *"… the revolution of desalination technology using CNT (carbon nanotubes) materials to mitigate few raised over concerns, particularly energy issues, seems a viable option."* Similarly, Buonomenna (2013) has optimistically observed, *"… nanotechnology has opened the way to*

produce nano-enhanced membranes (NEMs), i.e., membranes functionalized with discrete nanoparticles or nanotubes" The membrane filtration process is strongly linked to energy consumption and costs because filtration requires significant energy input and represents the greatest fixed cost of the desalination process.

Scientists from many countries have joined the MEDRC (Middle East Desalination Research Center) in researching and developing new technologies to lower costs and energy demands and increase efficiency. Moreover, on-going research projects intend not only to reduce energy consumption but also to replace fossil fuels (oil and gas) with renewable energy sources in the desalination process. According to Subramani (2011), *"Utilization of energy efficient design combined with high efficiency pumping and energy recovery devices have proven effective in full-scale applications"*. Important results have been achieved in this field. The Kwinana Desalination Plant in Australia is entirely powered by wind energy and provides 20% of Perth City´s freshwater requirements. A 48-wind-turbine farm generates as much as 80 megawatts, which is sufficient to produce 40 million gallons of drinking water each day (IDA, 2013b).

V Conclusions

Natural water scarcity cannot be conceived on a global scale because water is one of the most abundant resources on Earth, and water scarcity is a social rather than a natural phenomenon on regional and local scales. Therefore, we conclude that the idea of natural water scarcity is largely untenable. Because of the enormous quantity of water on Earth, considering the depletion of water stocks is not reasonable.

As the empirical example of Dubai confirms, significant quantities of freshwater can be produced. Thus, water resources should join the same category as mining or agricultural resources, for which humankind manipulates natural processes to respond to human needs.

Under this paradigm, water is not merely a renewable natural resource but a *producible* one. Finally, if freshwater can be produced at decreasing expense from an unlimited source (the ocean) and through the use of renewable energy, then water can be considered both a *producible* and *inexhaustible* resource. Hence, we can expect adequate global water supply for the foreseeable future and discard the notion of natural water scarcity.

References

Buonomenna MG (2013) Nano-enhanced reverse osmosis membrane. *Desalination* 314: 73-88.

Camp WG and Heath-Camp B (2009) *Managing our natural resources.* New York: Delmar Cencage Learning, 528 pp.

Companhia de Saneamento Básico do Estado de São Paulo (SABESP) (2012) *Relatório de Sustentabilidade.* [Online] Available: http://site.sabesp.com.br/uploads/file/sociedade_meioamb/RS_2012.pdf (April 7, 2014)

Dubai Energy and Water Administration (DEWA) (2013) *Statistics*. [Online] Available: http://www.dewa.gov.ae/aboutus/waterStats2013.aspx (December 20, 2013)

Gleick P (1993) Water and conflict: freshwater resources and international security. *Pacific Institute for Studies in Development, Environment and Security* 18: 79-112.

Goh PS and Ismail AF (2013) Carbon nanotubes for desalination: Performance evaluation and current hurdles. *Desalination* 308: 2-14.

International Desalination Association (IDA) (2013a) *Desalination by the numbers.* [Online] Available: http://www.idadesal.org/desalination-101/desalination-by-the-numbers/ (December 15, 2013)

International Desalination Association (IDA) (2013b) *Desalination overview.* [Online] Available: http://www.idadesal.org/desalination-101/desalination-overview/ (December 18, 2013)

Katz D (2011) Hydro-Political Hyperbole: Examining Incentives for Overemphasizing the

Risks of Water Wars. *Global Environmental Politics* 11: 12-35.

Mauser W (2009) *Water Resources: efficient, sustainable and equitable use.* London: Hans Publishing Ltd, 190 pp.

Middle East Desalination Research Center (MEDRC) *Desalination industry enjoys growth spurt as water scarcity stars to bite.* [Online] Available: http://www.medrc.org/index.cfm?area=about&page=Water_Scarcity_Starts_To_Bite (May 28, 2012)

Ministry of Information (2010) *Oman, 2010-2011.* Sultanate of Oman: Special Issue, 259 pp.

Ohlsson L (1999) *Environment, scarcity and conflict: a study of Malthusian concerns.* PhD thesis. Gothenburg: Gotemberg University Press.

Rebouças A (2004) *Uso inteligente da água.* São Paulo: Escrituras Editora, 207 pp.

Rebouças, A. (2003) O Paradoxo brasileiro. *Le Monde Diplomatique* 3: 38-41.

Sharqiyah Desalination Company (2012) *Sur Desalination Plant*. Sur: Official leaflet.

Simon JL (1980) Resources, Population, Environment: an oversupply of false bad news. *Science* 208: 1431-1437.

Singer E and Endreny P (1987) Reporting Hazards: their benefits and costs. *Journal of Communication* 37: 10-26.

Sistema Nacional de Informações sobre Saneamento (SNIS) (2010) *Diagnóstico dos Serviços de Água e Esgoto 2010.* [Online] Available: http://www.snis.gov.br/Arquivos_SNIS/5_DIAGNOSTICOS/5.1_Agua&Esgotos/5.1.16_Diagnostico2010/Tabela/Diagnostico_AE2010.zip (March 10, 2014)

Smith D (2008) *Atlas do Oriente Médio – o mapeamento completo de todos os conflitos.* São Paulo: Publifolha, 144 pp.

Subramani A, Badruzzaman M and Oppenheimer JGJ (2011) Energy minimization strategies and renewable energy utilization for desalination: a review. *Water Research* 45: 1907-1920.

Figures

Figure 1

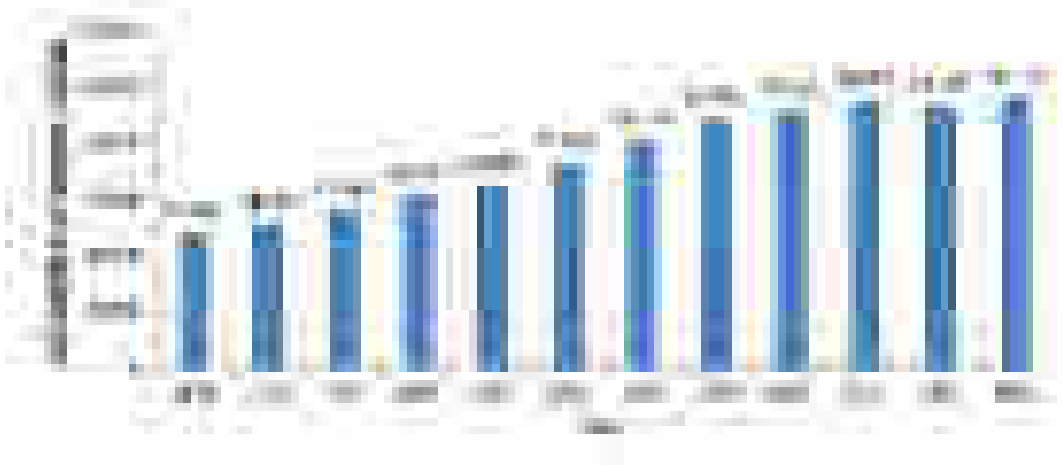


Figure 2

Figure 3

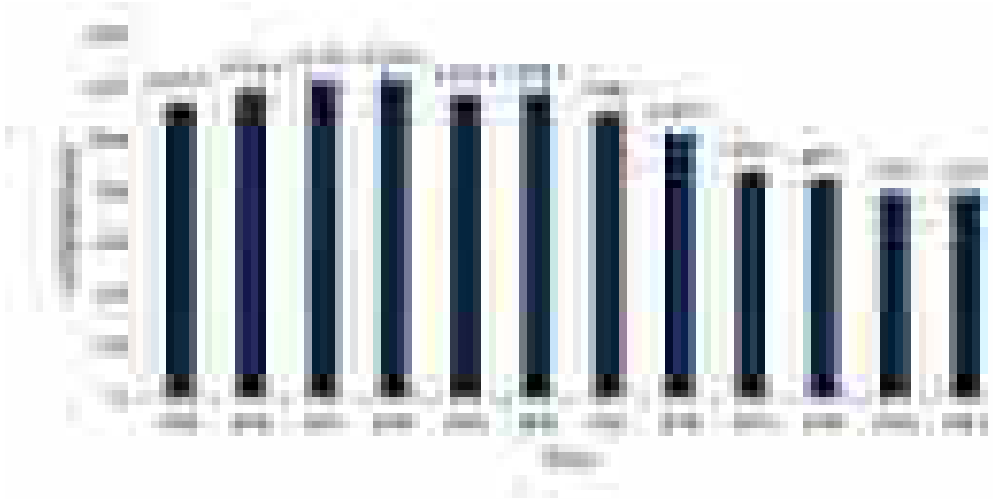
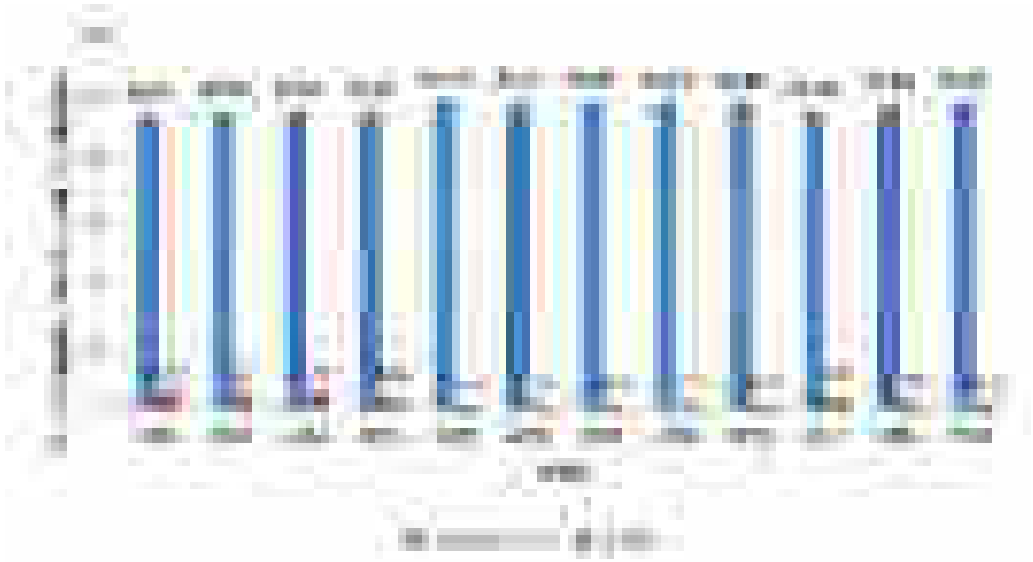


Figure 4

Figure 5



APPLICATION OF LOG-LINEAR MODEL TO DETERMINANTS OF CHILD MORTALITY IN NIGERIA

ADARABIOYO M.I

Department of Mathematics and Physical Sciences, Afe Babalola University, Ado-Ekiti, Nigeria

ABSTRACT

This study focuses on child mortality in Nigeria. A log-linear model is constructed to capture socio-economic and demographic factors. The model was estimated using Nigeria Demographic and Health Survey (NDHS). The estimated results show that socio-economic and demographic factors have significant impact on child mortality. The results show that improvement in socio-economic factors and demographic behaviors have direct impact on child mortality. The estimated model is expected to be used for policy experiments by promoting reduction in child mortality.

Key words: Log-linear, model, socioeconomic, demographic, mortality, policy, experiment, health, factors, survey

INTRODUCTION

Mortality of children under the age of five remains unacceptably high in many developing countries. A special edition of the Bulletin of the World Health Organization (WHO, 2000) stressed this point and noted that 10.5 million children still die each year. In Lopez's (2000) introductory comments to the WHO Bulletin, he emphasizes that child mortality needs to remain the focus of public policy to protect the gains in child survival from new threats such as HIV/AIDS. The report compares child mortality data from 56 countries and indicates where child survival gains are slipping and where they have yet to be made. Although initially there was controversy over whether childhood mortality levels were reversing direction (i.e., increasing), this phenomenon has been proven in a number of countries, primarily in sub-Saharan Africa. Some researchers thought that the increase was only a blip in the data and did not necessarily indicate a trend change (Ahmad et al., 2000). However, others found evidence of increasing childhood mortality due primarily to the increasing prevalence of AIDS in the population (Hill et al., 2001; Claeson et al., 2000; and Adetunji, 2000). Numerous causes have been cited for the reversal or stagnation of child survival. Adetunji (2000) concludes that not all of the stagnation in child mortality levels can be directly attributed to the prevalence of HIV/AIDS. The resurgence of malaria and lower levels of vaccination coverage and health care utilization have also contributed to the reversal of child survival trends (Rutstein, 2000). Deteriorating health systems have resulted in fewer children being vaccinated against childhood diseases, and thus increases or stagnation in mortality levels have occurred.

Several methods had been used to analyze the trend in infant and child mortality rates in the literatures. These include monitoring trends in under-five mortality rates through national birth history survey. The research was meant to find out the ability and reliability of the Demography and Health Survey to monitor the reduction in under-five mortality rates.

Different studies have been conducted to view the effects of different determinants on childhood mortality. Demographic research by Mosley and Chen (1984) and by Schultz (1984) has made the difference between variables considered to be exogenous or socioeconomic (i.e. cultural, social, economic, community, and regional factors) and endogenous or biomedical factors (i.e. breastfeeding patterns, hygiene, sanitary measures, and nutrition). The effects of the exogenous variables are considered indirect because they operate through the endogenous biomedical factors. Likewise, the

Bio-medical factors are called intermediate variables determinants because they constitute the middle step between the exogenous variables and child mortality (Jain, 1988; Mosley and Chen, 1984; Schultz, 1984; UN, 1985). Mosley and Chen (1984) were among the first to study the intermediate biomedical factors affecting child mortality, labeled `proximate determinants.' They distinguished 14 proximate determinants and categorized them into 4 groups: maternal [fertility] factors, environmental sanitation factors, availability of nutrients to the fetus and infant, injuries, and personal illness control factors. Klaauw and Wang (2003) develop a flexible parametric framework for analyzing infant and child mortality. This framework was based on widely used hazard rate models, which they extend with two features. First, the model allows individual characteristics and household's socio-economic and environmental characteristics to have different impacts on infant and child mortality at different ages. Second, they allow for frailty at multiple levels, which can be correlated with each other. They also use the estimated model to perform a number of policy experiments. The policy experiments show that infant and child mortality rates can be reduced substantially by improving the household's socio-economic and environmental characteristics. In a related study in Malawi, Espo (2002) employs logistic regression to assess associations between morbidity and various linear or dichotomous environmental predictor variables. The Kruskall Wallis non-parametric independent sample test and cross-tabulation with chi-square tests for statistical significance are used. The results indicate that source of drinking water and sanitation facilities were strong predictors of infant mortality. Woldemicael (1988) examines the effect of some environmental and socioeconomic factors that determine childhood diarrhea in Eritrea. He uses data from the 1995 Eritrea Demographic and Health Survey (EDHS). The method employed is logistic regression. The results show that type of floor material, household economic status and place of residence are significant predictors of diarrhea. A comparative study of urban areas of Ghana, Egypt, Brazil and Thailand by Timaeus and Lush (Timaeus and Lush, 1995) clearly indicates that children's health is affected by environmental conditions and economic status of the household. According to these authors, children from better-off households have lower diarrheal morbidity and mortality in Egypt, Thailand, and Brazil. Such differentials in diarrhea diseases by household economic status are probably due to differences in child care practices, for instance preparation of weaning foods and personal hygiene (Timaeus and Lush, 1995).

The Materials and Method

This study uses the 2008 Nigeria Demography and Health Survey (NDHS) dataset. The NDHS is a nationally representative survey. In 1999, 8,199 women age 15-49 and 3,082 men were interviewed. In 2003 NDHS, over 7000 households were sampled and women within the age 15-49 and men aged 15-64 were interviewed. While the 2008 survey consisted of 33,385 women aged 15-49 and 15486 men of aged 15-64 were interviewed. The survey were designed to provide information on levels and trends of fertility, family planning and practice, maternal and child health, infant and child mortality, and maternal mortality, as well as awareness of HIV/AIDS and other sexually transmitted diseases (STDs) and female circumcision. The DHS samples include data on birth history, household characteristics, health service usage, and child health, based on information collected from women at the time of the survey. The individual questionnaire was used to collect information from all women age 15-49. Birth files were generated from the eligible women's responses on their birth history.

The focus of this survey is on how child mortality can be explained by socioeconomic and demographic variables through a Log-linear approach.

In the 1970's, the analysis of cross-classified data changed quite dramatically with the publication of series of papers on log-linear models (Bishop, Finberg and Holland, 1975, Haberman, 1975). Log-linear models extend the principle of generalized linear models (GLM) to better treat the case of dichotomous and polychromous independent variables. It focuses on association of grouped data. Looking at all levels of possible interaction effects log-linear analysis is a type of multi-way frequency analysis. It uses the log of the dependent variable as its function. The major purpose of undertaking log-linear modelling is to determine the most parsimonious model which is not significantly different from the saturated model but trivially accounts for the distribution of data in the table. It uses the expected cell frequencies of a dependent variable and then confirms the models using a goodness-of-fit test and residual analysis to determine where the model is working better and worst. To consider how the type of model used in the analysis of variance (ANOVA) of quantitative data can arise for contingency table data. Returning for the moment to two-dimensional tables, the hypothesis of independence that is of no first-order interaction between the two variables specifies, as we see below:

$$P_{ij} = P_{i.}P_{.j} \qquad (1.0)$$

This relationship specifies a particular structure or model for the data, namely that in the population the probability of an observation falling in the ijth cell of the table is simply the product of the marginal probabilities. We now wish to ask how this model could be re-arranged so that Pij or some function of it can be expressed as the sum of the marginal probabilities or some function of them. The model would then begin to correspond to those found in the analysis of variance. By taking the natural logarithms of (1.0) such a relationship is easily found, namely:

$$\log_e P_{ij} = \log_e P_{i.} + \log_e P_{.j} \qquad (2.0)$$

This may be rewritten in terms of the theoretical frequencies,

Fij(F_{ij} = NP_{ij} etc) as; $$\log_e F_{ij} = \log_e F_{i.} + \log_e F_{.j} - \log_e N \qquad (3.0)$$

Summing (3.0) over *i* we have:

$$\sum_{i=1}^{r} \log_e F_{ij} = \sum_{i=1}^{r} \log_e F_{i.} + r \log_e F_{.j} - r \log_e N \qquad (4.0)$$

And over j:

$$\sum_{i=1}^{c} \log_e F_{ij} = c \log F_{i.} + \sum_{j=i}^{c} \log_e F_{.j} - c \log_e N \qquad (5.0)$$

And finally over I and j we have:

$$\sum_{i=1}^{r} \sum_{j=1}^{c} \log_e F_{ij} = c \sum_{i=1}^{r} \log_e F_{i.} + r \sum_{j=1}^{c} \log_e F_{.j} - rc \log_e N \qquad (6.0)$$

By simple algebra equation (3.0) can be rewritten in a form reminiscent of the models used in the analysis of variance, namely:

$$\log_e F_{ij} = \mu + \mu_{1(i)} + \mu_{2(j)} \qquad (7.0)$$

Where

$$\mu = \frac{\sum_{i=1}^{r} \sum_{j=1}^{c} \log_e F_{ij}}{rc} \qquad (8.0)$$

$$\mu_{1(i)} = \frac{\sum_{j=1}^{c} \log_e F_{ij}}{c} - \frac{\sum_{i=1}^{r} \sum_{j=1}^{c} \log_e F_{ij}}{rc} \qquad (9.0)$$

$$\mu_{2(j)} = \frac{\sum_{i=1}^{r} \log_e F_{ij}}{r} - \frac{\sum_{i=1}^{r} \sum_{j=1}^{c} \log_e F_{ij}}{rc} \qquad (10.0)$$

$$\log_e F_{ij} = \mu + \mu_{1(i)} + \mu_{2(j)} + \mu_{12(ij)} \qquad (11.0)$$

RESULTS AND DISCUSSION

In this study we used the cross-tabulations method and the chi-square statistics to determine existence of association between child survival and some selected socio-economic and demographic variables. The results show that level of education attained, region, place of residence, wealth index, sex of child and the age of mothers have greater influence on child mortality in Nigeria.

Higher level of education attainment has greater impact on child survival. The study revealed that a higher level of education attainment leads to reduction in the number of child death in Nigeria.

The table 1 shows that children born to mothers with no education have the highest value of deaths from 130.7 per 1000 to 106.7 per 1000 between 2008 and 2010. There was a reduction in child death as mothers' level of education increases. In other to achieve and sustain gradual reduction in child mortality by two-third according to Millennium Development Goals number four (MDGs 4), concerted effort must be made by all stakeholders globally to see to the education of a girl child. Basic education must be free or subsidized and made compulsory. This can also be achieved by the act of Parliament which will make the violators to be prosecuted and such a child or ward be taken from the custody of the parents for the period she would have had a basic education before reunion with the family.

The table 1 presents mortality disparity by background characteristics. Child mortality differs substantially between urban and rural areas, and is higher in rural areas for all categories. The results of the cross-tabulation revealed that 156 child deaths per 1000 live births occurred in rural area in 2008 as against 36 deaths per 1000 in urban area of Nigeria. This sharp disparity is an indication that the rural areas which account for over 70% of our population are under-developed and lacked in basic rural infrastructure like basic health facilities, good road, portable water, malnutrition and education.

The study also shows a sharp disparity in child mortality among various geo-political regions in Nigeria. From table 1, the regions in the Northern Nigeria recorded the highest child mortality of 68.6 per 1000 in the Northwest in 2008 while the Southern Nigeria with less child death has the least in Southwest with 11.4 deaths per 1000 in the same year under study. This finding is consistent with the NDHS 2008 report. The south western Nigeria was the first to embrace Western culture in terms of qualitative education, good healthcare services which had greater impact on the socioeconomic life of the people. The nomadic life of the Northern Nigeria has been a major setback for the regions with high level of illiterate, early marriage and poor healthcare system to mention but a few.

With inequality in the distribution of wealth of the nation, this also account for high child mortality in Nigeria. Children born in a family with poorest wealth quintile recorded 68.7 child deaths in 2008 against the richest wealth quintile of 11 deaths per 1000. As long as the wealth of the nation is in the hand of the few privilege ones child mortality reduction would be denied because there would be no sufficient provision to fund healthcare sectors and other basic infrastructure that would increase child survival in Nigeria.

Haven considered the results from cross-tabulations; we want to see whether any of the five factors; Mother's Highest Education, Region, Sex of Child, Place of residence and or Wealth index is a function of child mortality. In doing this we are going to employ the chi-square test of goodness of fit.
In this case, we shall select the more parsimonious (restricted) model because it can and will still explain the data equally well as the saturated model which possesses former relationships between variables. We achieve this through the use of backward selection procedure (Hierarchical log-linear modeling) of the log linear models. The procedure begins with the saturated model for child mortality with the designs.

Design = constant +Childsurv + Sex +Res + Region + Edu + Wealth +Childsurv*sex + Childsurv*Res + Childsurv*Region+ Childsurv*Edu + Childsurv*Wealth + Sex*Res + Sex*Region +Sex*Edu + Sex*Wealth + Res*region + Res*Edu + Res*Wealth + Region*Edu + Region*Wealth + Edu*Wealth+ Childsurv*Sex*Res + Childsurv*Sex*Reg + Childsurv*Sex*Edu + Childsurv*Sex*Wealth + Sex*Res*Region+ Sex*Res*Edu+Sex*Res*Wealth+Res*region*Edu+Res*Region*Wealth+Region*Edu*Wealth+ Childsurv*Sex*Res*Region + Childsurv*Sex*Res*Edu+ Childsurv*Sex*Res*Wealth + Sex*Res*Region*Edu + Sex*Res*Region*Wealth + Res*Region*Edu*Wealth

This is denoted by

$\ln (M_{ijklmn}) = \mu + \alpha_i + \alpha_j + \alpha_k + \alpha_l + \alpha_m + \alpha_n + \alpha_{ij} + \alpha_{ik} + \alpha_{il} + \alpha_{im} + \alpha_{in} + \alpha_{jk} + \alpha_{il} + \alpha_{jm} + \alpha_{jn} + \alpha_{kl} + \alpha_{km} + \alpha_{kn} + \alpha_{lm} + \alpha_{ln} + \alpha_{mn} + \alpha_{ijk} + \alpha_{ijl} + \alpha_{ijm} + \alpha_{ijn} + \alpha_{jkl} + \alpha_{jkm} + \alpha_{jkn} + \alpha_{kmn} + \alpha_{ijkl} + \alpha_{ijkm} + \alpha_{ijkn} + \alpha_{jklm} + \alpha_{jkln} + \alpha_{klmn} + \alpha_{ijklm} + \alpha_{ijkln} + \alpha_{jklmn} + \alpha_{ijklmn}$

i= 0, 1; j = 1, 2; k = 1, 2; l = 1, 2,…,6 m = 0, 1, 2, 3

n = 1, 2, 3, 4, 5

Where μ is the logarithm of the overall mean, the likelihood ratio and the Pearson chi-square for the model is also zero. These indicate that the model perfectly fits the data. Also in the test of significant for the K-way effects, it was discovered that elimination of the 5th and the 6th order with probabilities **0.545 and 0.904** are not significant. This shows that the particular effects had no contributions to the saturated model at 5% level of significance. But other single and higher effect interactions had significant contribution. The best model has generating class and can be represented as:

$\ln (Mijklmn) = \mu + \alpha_i + \alpha_j + \alpha_k + \alpha_l + \alpha_m + \alpha_n + \alpha_{ij} + \alpha_{ik} + \alpha_{il} + \alpha_{im} + \alpha_{in} + \alpha_{jl} + \alpha_{jm} + \alpha_{jn} + \alpha_{kl} + \alpha_{km} + \alpha_{kn} + \alpha_{ln} + \alpha_{ikl} + \alpha_{kln} + \alpha_{ikn} + \alpha_{kmn} + \alpha_{ijmn} + \alpha_{iklm} + \alpha_{ikmn} + \alpha_{klmn}$

i= 0, 1; j = 1, 2; k = 1, 2; l = 1, 2,…,6 m = 0, 1, 2, 3

n = 1, 2, 3, 4, 5

the above model represent a restricted model, a subset of the saturated model which best explain the various socioeconomic and demographic factors directly affecting child mortality in Nigeria. After the elimination of the fifth and sixth order higher interactions, the most parsimonious model was generated.

CONCLUSION AND RECOMMENDATION

Child mortality has taken a central position in our national discus and a topical issue to population researcher due to its direct link to lack of good healthcare facilities and poverty among its teeming population. This study has scientifically examined the socioeconomic and demographic determinants of child mortality in Nigeria using log-linear model. For purpose of robustness, a model selection technique procedure was explored. The model has shown that socioeconomic and demographic characteristics have significant impact on child mortality.

As for the socioeconomic variables, better survival prospect are found to exist in homes with higher educational level, higher income, those living in urban areas and southern part of Nigeria and among female children.

In pursuance of the objective of the MDGs to reduce child mortality by two-third by the year 2015, effort should be geared toward achieving this goal. This can be made possible by ensuring that this form part of the transformation agenda of the government. There should be adequate provision of

healthcare delivery at primary level particularly to the rural populace where the environment is endemic to child killer diseases. Environmental services such as good sanitary condition and waste disposal should be provided. Education of the girl-child, enabling environment that would boost socioeconomic activities of the populace particularly at the grass root should be provided as this will help to bridge the gap between the poor and the rich. All tiers of government including private and corporate organisations should key into the national policies that will reduce child mortality rate by two-third before the year 2015.

Table 1: Child mortality by Socioeconomic and Demographic Characteristics

Background Characteristics	2008	2010
Residence		
Urban	36	35
Rural	156	125
Region		
North Central	27	28
North East	54	39
North West	69	52
South East	14	17
South South	17	17
South West	11	9
Highest Education		
No education	131	107
Primary	40	31
Secondary	19	20
Higher Institution	3	3
Wealth Quintile		
Poorest	69	41
Poorer	56	42

Middle	37	35
Richer	23	27
Richest	11	16
Sex		
Male	102	87
Female	89.9	73

SOURSE: Computed from cross tabulation results from DHS datasets, 2008 and 2010

Table 2: Tests for K-way and higher-order effects

K-way and higher-order effects	DF	LR
	Sig.	
1	959	283608
2	0.000	
3	944	127128
4	0.000	
5	858	5465.214
6	0.000	
	260	1191.023
K-way efects	0.000	
	287	285.117
1	0.545	
2	60	48.119
3	0.904	
4		
5		
6		
	15	156479
	0.000	
	86	121663
	0.000	
	238	4274.19
	0.000	

	333	905.906
	0.000	
	227	236.998
	0.304	
	60	48.119
	0.904	

Table 3: Tests for Partial Association

Effects	df	Partial Chi-square	Sig.
B5*B4*V106*V190	12	33.907	
0.001			
B5*V025*V106*V024	15	26.461	
0.033			
B5*V106*V190*V024	60	121.128	
0.000			
V025*V106*V190*V024	60	500.55	
0.000			
B5*V025*V024	5	12.194	
0.032			
V025*V190*V024	15	268.426	
0.000			
B5*V190*V024	20	137.035	
0.000			
V106*V190*V024	60	1122.781	
0.000			
B5*B4	1	39.828	
0.000			
B5*V025	1	7.214	
0.007			
B5*V106	3	269.182	
0.000			
B4*V106	3	35.056	
0.000			

V025*V106	3	17.00
0.001		
B5*V190	4	195.053
0.000		
B4*V190	4	13.206
0.010		
V025*V190	12	2572.7
0.000		
B5*V024	5	519.701
0.000		
B4*V025	5	8.367
0.137		
V025*V024	5	3158.268
0.000		
V106*V024	15	18463.5
0.000		
V190*V024	20	10881.0
0.000		
B5	1	42721.0
0.000		
B4	1	71.499
0.000		
V025	1	26609.9
0.000		
V106	3	60978.6
0.000		
V190	4	8331.638
0.000		
V024	5	17766.7
0.000		

B5: Is Child alive?; B4: Sex of Child; V024: Type of Place of Residence; V025: Region/geo-political location; V106: Mother's Highest Education; V190: Wealth Index

Reference

1. Black RE, Morris SS, Bruce J (2003). where and why 10 million children dying every year; Lacet 2003; 36:2226-34
2. Bishop, Finberg and Holland,1975. Discrete Multivariate Analysis: theory and Practice. Cambridge, M.A: MIT Press, 557p.
3. E L Kovenromp, F Amold; Monitoring trend in under five mortality rates through national birth history surveys: International Journal of Epidemiology volume 33, Number 6 Pp 1293-1301
4. Fayehun, Olufunke A. 2010. *Household Environmental Health Hazards and Child Survival in Sub-Saharan Africa*. DHS Working Papers No. 74. Calverton, Maryland, USA: ICF Macro.
5. Hill, K., G.T. Bicego, and M. Mahy. 2001. Childhood mortality in Kenya: An examination of trends and determinants in the late 1980s to mid-1990s. Johns Hopkins Population Center Working Paper. Baltimore, Maryland: Johns Hopkins University.
6. Lee R (2000), The Lee-Carter method of forecasting mortality, with various extensions and applications, North American Actuarial Journal vol. 4, No1
7. Mohammed Zathir and Phanindra V, Factors affecting infant mortality rates: evidence from cross-sectional data; Applied Economics Letters, 1999, 6, 271-273
8. Rasheed Kola Ojikutu (2008): Pattern in under-five mortality in Lagos, Nigeria. Sudanese Journal of Public Health, Vol 3(4), pp 176-185
9. Rutstein, S.O. 1984. *Infant and child mortality: Levels, trends, and demographic differentials.* World Fertility Survey Comparative Studies No 43. Cross-national Summaries. Voorburg, Netherlands: International Statistical Institute.