Assiut University Center for Environmental Studies-Egypt

The 9th Int. Conf. for Develop. and the Env . in the Arab world, April, 15-17, 2018

SEASONAL VARIATION OF WATER RESOURCES AND ITS SUITABILITY FOR DRINKING WATER PRODUCTION.

Asmaa H.B. AlRashedy, Rateb A.Youssef, Safinaz A Farfour and Ibrahim E. Mousa*

Environmental Biotechnology Department, *Genetic Engineering & Biotechnology Institute (GEBRI), University of Sadat city, Egypt.

Ibrahim.mousa@gebri.usc.edu.eg

ABSTRACT

High polluted water resources and drinking water treatment are supposed to be one of the most important human health issues. Two major canals in Sidi Salem city, Kafr El-Sheikh Governorate have facing quality fluctuation. This study is aimed to investigate the transport and fate of soluble ammonia in water resources through examining seasonal and spatial variations of physicochemical parameters. The weekly samples were taken for chemical, physical and microbiological surveys. The result shows that the mother water source is the main responsible for water pollution rather than human activities close to canal. Meet Yazied canal less polltuted than Elbahr Elseedy canal in all water quality parameters except turbidity. Low water level in winter seasons had significant effect with the low water quiality in both canal. In the same time, wastewater from aquaculture industries must be considered as a part of a general integrated wastewater management plan. Therefore, selected treatments and cost-efficient techniques should be developed to control the spread of pollution into the environment.

Key words: *Ammonia, water resources, physical, chemical assessment, Heavy metals, biological characters.*

INTRODUCTION

The requirement for water is increasing while slowly all the water resources are becoming unfit for use due to improper waste disposal. High polluted water resources with ammonia that used for drinking water treatment are supposed to be one of the most important issues (Erdem *et al.*, 2004). In Egypt, drinking water treatment plants are constructed in order to remove organic compounds in an efficient way by disinfection, coagulation and filtration. These treatments are the common methods applied in water treatment but are not considered advanced enough for total ammonia nitrogen and nitrate ions removal. So, there are a few techniques available to remove TAN and nitrate ions that are divided into two main categories: physicochemical and biological (Mook *et al.*, 2012) physicochemical treatment technologies were employed for ammonia removal from domestic and industrial wastewaters, which are air stripping, ion exchange, and breakpoint chlorination reverse osmosis (RO), electro dialysis (ED) and activated carbon adsorption. Reverse osmosis (RO) has potential to remove ions, proteins and organic chemicals in brackish water and seawater (Afonso *et al.*, 2004;Hilal *et al.*, 2004;Kim *et al.*, 2009). Although air stripping and ion exchange are widely used, they transfer contaminants from one medium to another. There is no destruction of the contaminant. Consequently, it needs to be further treated (Huang et al., 2008; Feng et al., 2003). Breakpoint chlorination demands a large amount of chlorine and

relatively inefficient (Jensen and Johnson, 1989;Li *et al.*, 2011). Nitrogen-containing compounds are examples of those contaminants which can create serious problems when released into the environment, such as eutrophication of rivers (Sumino *et al.*, 2006), deterioration of water quality and potential hazard to human or animal health. Nitrate is one of these compounds, though it does not pose a human or animal health threat by itself. It is potentially converted to nitrite in the gastrointestinal tract or to nitrous nitrogen compounds through reduction (Foglar *et al.*, 2005). Ammonia (NH_3) is the product of fish respiration and decomposition of excess organic matter. Chemoautotrophic bacteria (Nitrosomonas and Nitrobacter) tend to oxidize ammonium ions (NH_4^+) to nitrite (NO_2^-) and nitrate (NO_3^-) ions. Nevertheless, these ions are removed by aquatic plants, algae and bacteria since they assimilate them as a source of nitrogen (Camargo *et al.*, 2005).

Present paper has collected water quality data for different seasons and has analyzed it using a statistical technique. This study is aimed to investigate water quality in tow major canals in Sidi Salem city, Kafr El-Sheikh Governorate through examining seasonal and spatial variations of physicochemical parameters and assessment of bacteriological characteristics. The research work of this paper can be used for investigations of other similar systems threatened by contamination due to urbanization land use changes and recreational activities.

MATERIAL AND METHODS

1. Water Sampling

Raw water samples were taken Weekly and monthly from selected sampling sites according to study plan. Samples were collected manually at about 30 cm under water surface in appropriate, clean, free of analyst of interest and free of contaminants containers. Suitable amounts of raw water were collected according to each test requirements. Each lab conditions and instructions for sample collection, storage and preservation were exactly followed and performed according to Standard methods of water and wastewater. The temperature of the sample was maintained at ambient conditions prior to and during testing. The collected water was stored and refrigerated (at 4 °C) for subsequent testing. The temperature of the sample was adjusted to room temperature before initiating any test. On the other hand, turbidity and pH were measured in field (Eaton *et al.*, 2005). The samples were taken for chemical, physical and microbiological surveys. For chemical and physical analysis (PH- turbidity- conductivity - alkalinity – chlorides – total hardness- Ca- hardness-–Ammonia-Nitrite-Nitrate)., Tow liter surface water samples were taken from each sampling site weakly. All samples were analyzed about 2 hours after collection and for microbiological analysis 1 liter surface water samples were taken from each sampling site monthly during the period 9/2013 to 8/2014.

1.1. Study area:

Raw water samples were taken from Inlet of Abd El-Rahman Water Purification plant on Elbahr Elseedy canal which off- take from Rosetta branch, In the west side of Sidi-Salem city, Kafr El-Sheikh, Egypt. Its coordinates are N 31º 17 ' 20. 67''; E 30º 41' 58 .28 '' as showed in (Fig 1a). Also, Inlet of Elmofty Water Purification Plant on Meet Yazied canal which off-take from Damietta branch. At the east side of Sidi-Salem city, Kafr El-Sheikh, Egypt. Its coordinates are N 31º 51' 17. 27''; E 30º 52' 25 .45''.as showed in (Fig 1b). Samples were collected during the period from October, 2012 to December, 2014.

(a) (b)

Fig. (1): A satellite image showing sampling site for Elbahr Elseedy (a) and Meet Yazied (b) canals.

2. Physical and chemical analyses of water samples

The quality of water samples was determined by measuring pH, electrical conductivity (EC), turbidity, chloride, total alkalinity, total hardness, Calcium hardness and Magnesium hardness,. Nitrogen forms i.e. free ammonia, nitrate and nitrite were also measured. Heavy metals were measured by Flame Atomic Absorption Spectrometry. All the physicochemical analyses were done in duplicates and determined by the procedures of Standard Methods done for the Examination of Water and Wastewater (Eaton et al., 2005).

3. Microbiological analysis of water samples

The heterotrophic plate count (HPC) is a procedure for estimating the number of live heterotrophic bacteria in water. Colonies may arise from pairs, chains, clusters, or single cells, all of which are included in the term ''colony-forming units'' (CFU). The enumeration of total bacterial count (TBC) in water samples was done using the spreading plate technique over Plate count agar medium (Tryptone glucose yeast agar) which is high-nutrient agar, widely used medium for heterotrophic plate count. Each water sample was serially diluted to a suitable concentration.

Detection of total coliform bacteria was based on membrane filter technique using selective media (m- Endo agar) m Endo agar, which is Base for enumerating coliforms in water by membrane filtration. Samples that yielded counts between 20-60 CFU/membrane were diluted with 100 ml sterile dilution water and were filtered under vacuum. Additional controls were prepared to determine contamination of plates, pipets, and room air.

Detection of Fecal coliform bacteria was based on membrane filter technique using selective media m-FC agar, which is Base for enumerating fecal coliforms in water by membrane filtration. A filtration system was used for filtering 100 ml of water samples. Sterility of medium and dilution water blanks were Checked by pouring control plates for each series of samples. Additional controls were prepared to determine contamination of plates, pipets, and room air.

Detection of Fecal Streptococcus (FS) bacteria was based on membrane filter technique using selective media (m-Enterococcus Agar), which base for isolating and enumerating *Enterococci* in water by membrane filtration. A filtration system was used for filtering 100 ml of water samples (Eaton *et al.*, 2005)..

4. STATISTICAL ANALYSIS

The data were analyzed using statistical software (SPSS Version 17, SPSS INC, Chicago, IL, USA). Initially, the descriptive statistics were computed. One-way ANOVA was used followed by Duncan's post hoc test (α0.05). In all tests, p values smaller than 5% were considered statistically

RESULTS AND DISCUSSION

Ammonia of the water resources is one of the major technical, environmental, and economical problems associated with drinking water production in north Egypt (Nora'aini *et al.*, 2005). As showed in Table (1&2) and Figure (2). Elbahr Elseedy canal samples recorded the highest salts content comparing to Meet Yazied canal specially in autumn 2013 and autumn 2014 and showed significant increase more than all samples during all seasons, while the lowest value were recorded in summer 2014. Also, both showed significant decreases in summer seasons for all parameters except turbidity degrees.

Table (1) **Seasonal variation of different parameters values of water sampled from two different water resources.**

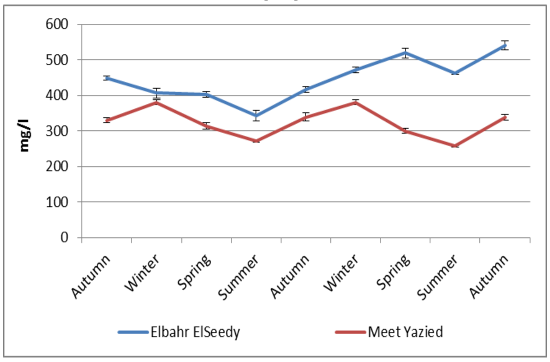
Parameter / Season	pH		Turbidity (NTU)		Conductivity (µs/cm)		Alkalinity mg/l	
	Elbahr ElSeedy	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**
Autumn	7.91 ^{b} ± 0.05	7.68 ^{fh} ± 0.01	5.22 ^{h} ± 0.43	18.40 ^{cd} ± 0.97	660.7 ^{d} ± 8.12	476.1 ^{h} ± 10.06	234.8 ^{b} ± 5.70	178.4 ^{df} ± 4.49
Winter	7.79 ^{ce} ± 0.02	7.55 ^{j} ± 0.02	5.61 ^{h} ± 0.41	15.54 ^{de} ± 1.36	759.8 ^{b} ± 17.21	558.3 ^{f} ± 10.15	245.0 ^{a} ± 6.56	165.8 ^{gh} ± 3.96
Spring	7.82 ^{cd} ± 0.01	7.64 ^{hi} ± 0.01	9.18 ^{fg} ± 0.50	21.81 ^{bc} ± 0.60	592.5 ^{ef} ± 12.22	465.9 ^{h} ± 11.98	186.9 ^{d} ± 3.54	142.6 ^{j} ± 2.56
Summer	7.73 ^{ef} ± 0.01	7.60 ^{ij} ± 0.01	7.10 ^{h} ± 0.22	16.76 ^{de} ± 1.00	578.4 ^{ef} ± 6.68	412.0 ^{i} ± 6.05	173.5 ^{fg} ± 2.14	135.2 ^{j} ± 2.40
Autumn	7.99 ^{a} ± 0.04	7.78 ^{ce} ± 0.02	6.36 ^{h} ± 0.21	10.26 ^{f} ± 0.72	612.2 ^{e} ± 12.06	523.2 ^{g} ± 11.35	183.5 ^{de} ± 2.63	152.5 ^{I} ± 1.45
Winter	7.82 ^{c} ± 0.02	7.63 ^{hi} ± 0.02	7.24 ^{gh} ± 0.34	15.99 ^{de} ± 0.60	694.9 ^{cd} ± 11.62	579.5 ^{ef} ± 12.41	195.8 ^{c} ± 2.69	161.7 ^{h} ± 2.26
Spring	7.82 ^{cd} ± 0.01	7.67 ^{gh} ± 0.02	7.29 ^{gh} ± 0.49	24.37 ^{a} ± 0.76	732.4 ^{b} ± 10.14	454.4 ^{h} ± 11.30	201.1 ^{c} ± 2.56	152.5 ^{I} ± 1.90
Summer	7.73 ^{eg} ± 0.02	7.60 ^{ij} ± 0.02	9.23 ^{fg} ± 0.33	23.25 ^{ab} ± 0.67	679.9 ^{cd} ± 3.56	389.0 ^{i} ± 4.67	167.7 ^{gh} ± 0.90	137.9 ^{j} ± 2.38
Autumn	7.98 ^{a} ± 0.03	7.75 ^{de} ± 0.02	6.78 ^{h} ± 0.34	14.5 ^{e} ± 1.02	794.8 ^{a} ± 18.03	512.2 ^{g} ± 12.22	177.5 ^{ef} ± 1.43	166.3 ^{gh} ± 1.71

- Means with the same letter(s) of the same parameter are not significantly different at $p \geq 0.05$.
- Data are represented as Mean ± SE SE = Standard error.
- Number of observation in each mean =5

During the whole sampling period it was noticed that the maximum increase in pH values was recorded during autumn seasons in Elbahr Elseedy canal that agrees with (Moghazy, et al. 2015) the relatively higher pH of water can be attributed to the large amounts of different pollution sources discharged. The Maximum turbidity values were observed during spring and summer in Meet Yazied and the lowest values were recorded during autumn in Elbahr Elseedy samples Due to winter block of Nile River in cold seasons which cause stagnant of water this agrees with the finding by (Abdo 2013).Values increase more over especially in winter season where organic matter increases in the river

during this period because of the winter block. Such results were given by (Abd El-Hady & Hussian 2012). The total hardness (TH), calcium hardness (Ca–H), magnesium hardness (Mg–H) is regulated largely by the levels of Ca and Mg salts. Other metals if present such as Fe, Mn, and Al may also contribute to hardness (Singh *et al.* 2005). The Maximum values were recorded in Elbahr Elseedy samples during autumn and winter seasons as shown in Table (2) and Figure (2). The lowest values were recorded in Meet Yazied samples during summer season, that agrees with (Osman and Kloas 2010) who illustrate that Water hardness was increased from Aswan to Rosetta and Damietta branches and recording the highest value at Rosetta branch.

(a)



(b)

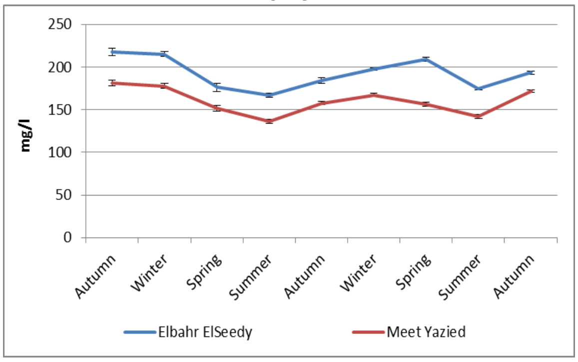


Figure (2): **Seasonal variation of total dissolved solids (a) and total hardness (b) values in mg/l of water sampled from two water resources during studying period.**

Table (2):**Seasonal variation of salts values in mg/l of water sampled from two different water resources.**

Parameter / Season	Chlorides mg/l		Ca. Hardness mg/l		Ca . mg/l		Mg. Hardness mg/l		Mg . mg/l	
	Elbahr ElSeedy	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**
Autumn	63.6 ^{b} ± 1.77	42.2 ^{e} ± 2.65	119.4 ^{a} ± 2.31	100.8 ^{ef} ± 2.44	47.76 ^{a} ± 0.92	40.3 ^{de} ± 0.98	98.2 ^{ab} ± 2.41	80.4 ^{de} ± 3.64	23.33 ^{ab} ± 0.72	18.78 ^{ef} ± 0.62
Winter	75.1 ^{a} ± 2.40	51.7 ^{d} ± 2.08	114.2 ^{b} ± 1.59	100.7 ^{ef} ± 1.46	45.7 ^{b} ± 0.63	40.3 ^{de} ± 0.59	100.8 ^{a} ± 1.68	77.2 ^{ef} ± 1.57	24.50 ^{a} ± 0.41	18.75 ^{ef} ± 0.38
Spring	53.2 ^{cd} ± 2.23	32.9 ^{fg} ± 1.42	95.2 ^{gh} ± 2.66	84.2 ^{kL} ± 2.18	38.0 ^{fg} ± 1.07	33.7 ^{jk} ± 0.85	81.1 ^{de} ± 2.46	67.9 ^{h} ± 1.79	19.70 ^{de} ± 0.60	16.48 ^{g} ± 0.43
Summer	41.9 ^{e} ± 1.75	27.0 ^{h} ± 0.73	89.5 ^{ij} ± 1.43	73.5 ^{m} ± 1.16	35.8 ^{hi} ± 0.56	29.5 ^{L} ± 0.47	77.4 ^{ef} ± 1.31	62.8 ^{I} ± 1.76	18.80 ^{ef} ± 0.32	15.24 ^{h} ± 0.43
Autumn	67.1 ^{b} ± 2.07	39.8 ^{e} ± 1.94	97.9 ^{fg} ± 1.93	82.2 ^{kL} ± 1.02	39.1 ^{df} ± 0.77	32.8 ^{jk} ± 0.41	86.2 ^{c} ± 1.83	74.8 ^{fg} ± 1.31	20.93 ^{c} ± 0.45	18.14 ^{f} ± 0.31
Winter	74.9 ^{a} ± 2.10	56.0 ^{cd} ± 1.31	103.4 ^{de} ± 1.38	90.8 ^{hi} ± 1.75	41.1 ^{d} ± 0.60	36.4 ^{gh} ± 0.68	94.6 ^{b} ± 0.86	76.6 ^{ef} ± 1.29	22.99 ^{b} ± 0.21	18.65 ^{ef} ± 0.33
Spring	72.2 ^{a} ± 1.06	40.4 ^{e} ± 2.74	111.7 ^{bc} ± 1.52	85.1 ^{jk} ± 1.39	44.7 ^{bc} ± 0.61	34.1 ^{ij} ± 0.54	97.1 ^{ab} ± 1.46	70.5 ^{gh} ± 1.79	23.51 ^{ab} ± 0.37	17.80 ^{f} ± 0.50
Summer	57.5 ^{c} ± 1.33	28.8 ^{gh} ± 0.82	98.0 ^{fg} ± 0.85	79.9 ^{L} ± 1.37	38.9 ^{ef} ± 0.42	31.9 ^{k} ± 0.55	77.1 ^{ef} ± 1.19	62.9 ^{I} ± 1.46	18.69 ^{ef} ± 0.29	15.27 ^{h} ± 0.35
Autumn	65.2 ^{b} ± 1.79	34.4 ^{f} ± 1.11	107.7 ^{cd} ± 1.63	99.7 ^{eg} ± 1.13	43.1 ^{c} ± 0.63	39.9 ^{df} ± 0.45	83.7 ^{ce} ± 1.41	72.3 ^{fh} ± 1.19	20.32 ^{cd} ± 0.35	17.54 ^{fg} ± 0.29

- Means with the same letter(s) of the same parameter are not significantly different at $p \geq 0.05$.
- Data are represented as Mean ± SE SE = Standard error.
- Number of observation in each mean =5

The maximum increase in ammonia and nitrite levels was recorded during autumn season and the lowest value was recorded in spring while ammonia not detected in Meet Yazied canal as shown in Figure (3). These results agree with (Abdo, 2013) who found that The highest concentration values were recorded during cold seasons this may be related to the low water levels and the leaching of fertilizer residues used on the agriculture into the aquatic environment. This result is coincident with that reported by (Abdel-Satar 2005; Ahmed *et al.*, 2011) who explained that the increase in the ammonia concentrations was related to the decrease in biological activities of aquatic organisms and nitrification. Also these results agree with (Khairy *et al.*, 2015) who denoted that high counts of diatoms were recorded during summer and this increase was accompanied with the highest values of ammonia. Mentioned these results disagree with those by (Hassanein *et al.*, 2013) who illustrated that high temperature accelerate the reduction rate of nitrate into ammonia also, ammonia in Nile water had positive correlation with temperature and nitrate.

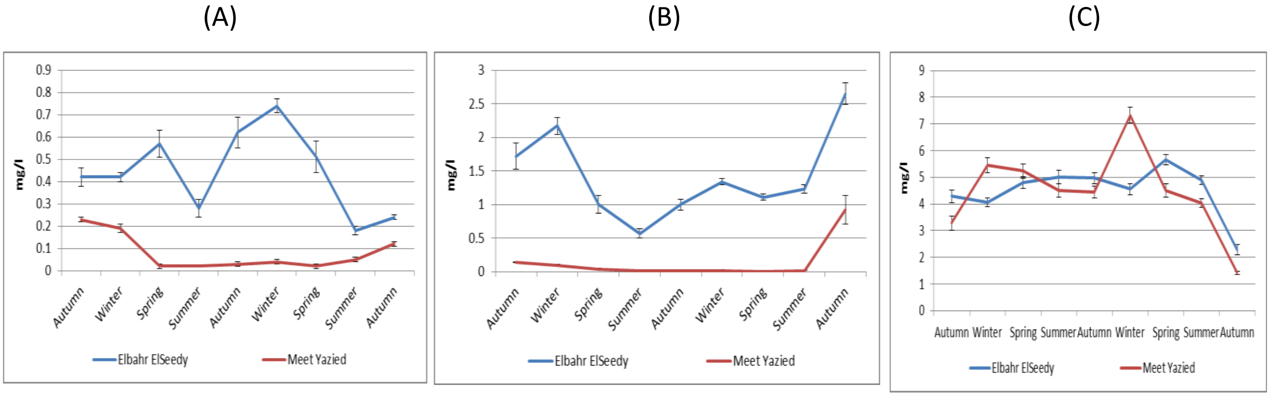


Figure (3): Seasonal variation of Nitrite (A), Ammonia (B) and Nitrate (C) values in mg/l of water sampled from two water resources.

Heavy metals concentrations were under detectable level in two locations in different seasons and samples didn't differ mostly from each other while the two locations showed some significant elevations. Meet Yazied canal water recorded the highest value in autumn 2013 as shown in Table (3). The low levels of most elements in the results may be due to the absence of industrial wastes, and these results agree with (Awad *et al.*, 2015) who explained that the presence of high copper and iron concentrations in Meet Yazied canal water could be usually attributed to industrial wastes or agricultural sources for the control of algae and other aquatic growths.

Table (3): **Seasonal variation of heavy metals values in mg/l of water sampled from two different water resources.**

Parameter / Season	Copper		Manganese		Iron		Zink		Cadmium		Lead	
	Elbahr ElSeedy	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**
Autumn	0.12 ^{a} ± 0.09	0.14 ^{a} ± 0.11	0.10 ^{ab} ± 0.00	0.05 ^{ab} ± 0.05	0.23 ^{bc} ± 0.01	0.32 ^{ac} ± 0.01	ND	ND	0.02 ^{b} ± 0.02	0.05 ^{ab} ± 0.01	0.66 ^{a} ± 0.16	0.51 ^{ab} ± 0.01
Winter	ND	ND	0.08 ^{ab} ± 0.03	0.03 ^{ab} ± 0.01	0.39 ^{ac} ± 0.18	0.57 ^{ac} ± 0.28	ND	ND	0.17 ^{a} ± 0.16	ND	0.48 ^{ac} ± 0.26	0.39 ^{ac} ± 0.06
Spring	0.01 ^{b} ± 0.00	0.01 ^{b} ± 0.00	0.14 ^{a} ± 0.02	0.13 ^{a} ± 0.03	0.55 ^{ac} ± 0.05	1.17 ^{a} ± 0.15	0.01 ^{a} ± 0.00	ND	ND	ND	0.24 ^{ac} ± 0.23	0.26 ^{ac} ± 0.14
Summer	0.01 ^{b} ± 0.01	0.01 ^{b} ± 0.01	0.11 ^{ab} ± 0.06	0.07 ^{ab} ± 0.07	0.28 ^{bc} ± 0.28	0.91 ^{ab} ± 0.59	ND	ND	ND	ND	0.01 ^{c} ± 0.01	0.14 ^{bc} ± 0.14
Autumn	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.20 ^{ac} ± 0.20	0.27 ^{ac} ± 0.14
Winter	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.37 ^{ac} ± 0.20	0.11 ^{bc} ± 0.11
Spring	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Summer	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

- Means with the same letter(s) of the same parameter are not significantly different at p ≥ 0.05.
- Data are represented as Mean ± SE SE = Standard error. ND=not detected
- Number of observation in each mean =5

Microbial loads were recorded in Elbahr Elseedy and Meet Yazied during the period from autumn 2013 to Summer 2014, and the Table (4) showed that total count, total coliform, fecal coliform and Fecal Streptococcus counts showed elevation of Elbahr Elseedy sample in all seasons more than Meet Yazied samples with higher values during winter 2014 in Elbahr Elseedy, while during summer 2014 the lowest value were recorded in Meet Yazied.

Table (4): **Seasonal variation of microbial loads (total count, total coliform, fecal coliform and Fecal Streptococcus) of water sampled from two different water resources.**

Parameter / Season	Total Bacterial Count CFU/ml		Total Coliform Count CFU/100ml		Fecal Coliform Count CFU/100ml		Fecal Streptococcus Count CFU/100ml	
	Elbahr ElSeedy	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**	**Elbahr ElSeedy**	**Meet Yazied**
Autumn	1800.0 ^{bc} ± 57.74	1566.7 ^{cd} ± 33.33	6166.7 ^{b} ± 88.19	5166.7 ^{c} ± 88.19	2866.7 ^{c} ± 88.19	2200 ^{d} ± 57.74	1300 ^{ab} ± 57.74	866.7 ^{d} ± 120.19
Winter	2133.3 ^{a} ± 88.19	1933.3 ^{ab} ± 88.19	7900 ^{a} ± 404.15	6400 ^{b} ± 208.17	4000.0 ^{a} ± 88.19	3266.7 ^{b} ± 202.76	1466.7 ^{a} ± 88.19	1166.7 ^{bc} ± 88.19
Spring	1966.7 ^{ab} ± 120.19	1666.7 ^{cd} ± 33.33	6566.7 ^{b} ± 145.30	5433.3 ^{c} ± 88.19	3400 ^{b} ± 152.75	2266.7 ^{d} ± 120.19	1100 ^{bd} ± 57.74	600 ^{d} ± 57.74
Summer	1700 ^{cd} ± 57.74	1500 ^{d} ± 57.74	6366.7 ^{b} ± 176.38	5033.3 ^{c} ± 260.34	2433.3 ^{d} ± 115.47	1633.3 ^{e} ± 88.19	933.3 ^{cd} ± 88.19	900 ^{e} ± 57.74

- Means with the same letter(s) of the same parameter are not significantly different at p ≥ 0.05.
- Data are represented as Mean ± SE SE = Standard error - Number of observation in each mean =5

The lowest total and fecal coliform counts were measured during summer season in Meet Yazied samples while the highest counts were recorded in winter season in Elbahr Elseedy samples which indicated the higher activity of total and fecal coliform bacteria during winter season because of winter

block of Nile River, increase of pollutants, nutrients and favorable growth conditions. Also, this might be attributed to human sewage pollution associated with high organic loads favouring the bacterial survivability, this findings agreed with (Gad, 2005). The Maximum Fecal Streptococci values were observed during winter 2014 in Elbahr Elseedy samples and the lowest values were recorded during spring 2014 in Meet Yazied samples. *faecal streptococci* are associated with fecal material from human and other warm- blooded animals and their presence in water indicates the potential incidence of enteric pathogens that could cause illness in exposed individuals this agreed with (Hassanein *et al*., 2013) who cleared that the high amount of *Faecal streptococci* was found due to the discharge of human and animal wastes in the Nile River.

Elbahr Elseedy canal is more polluted than meet Yazied canal. Major sources of pollution of Rosetta branch is El-Rahawy Drain (Reverse impact on Elbahr Elseedy canal water quality). Meet Yazied canal less polltuted than Elbahr Elseedy canal in all water quality parameters except turbidity. Low water level in winter seasons had significan effect with the low water quiality in both canal. High polluted water with ammonia can limit the productive of treatment plants and can cause severe problems. Contaminated water with ammonia represents the largest waste stream associated with aquaculture industry. The intensive development in the aquaculture industry has caused major environmental impacts.

Wastewater discharged from aquaculture contains nitrogenous compounds, phosphorus and dissolved organic carbon, which cause environmental deterioration at high concentrations. Also, Iram *et al.* (2009) have investigated that there are some agricultural activities in the catchment area of Lake and the farmers use pesticides and herbicides in agriculture. The toxic chemicals are washed away by excess irrigation water which enters the water streams. Ahad *et al.* (2005) have also reported the presence of pesticides residues in water body. Therefore, selected treatments and cost-efficient techniques should be developed to control the spread of this pollution into the environment. In the same time, wastewater from aquaculture industries must be considered as a part of a general integrated water resource management plan in places that face water scarcity

ACKNOWLEDGMENTS

This study was supported by a funding from science technology development fund (STDF#4786) and scientific research academy.

REFERENCES

Abd El-Hady, H.H. and Hussian, A.E.M. (2012). Regional and seasonal variation of phytoplankton assemblages and its biochemical analysis in ismailia canal, Nile River, Egypt. Journal of Applied Sciences Research, 8: 3433–3447.

Abdel-Satar, A.M. (2005). Water quality assessment of river nile from Idfo to Cairo. Egyptian Journal of Aquatic Research, 31: 200-223.

Abdo, M. (2013). Physico-chemeical studies on the pollutants effect in the aquatic environment of Rosetta branch, Nile River, Egypt. Life Science Journal, 10: 493-501

Afonso, M.D., Jaber, J.O. and Mohsen, M.S. (2004). Brackish groundwater treatment by reverse osmosis in jordan. Desalination, 164: 157-171.

Ahad, K., Mohammad, A., Mehboob, F., Sattar, A. and Ahmad, I. (2005). Pesticide residues in Rawal Lake, Islamabad, Pakistan. Bulletin of Environmental Contamination and Toxicology, 76, 463–470.

Ahmed, S., Nasr, A.M., El-Sayed, E.-D.A., Ismaiel, T.S. and Mohamed, A.N. (2011). Haematological and histopathological studies on clarias gariepinus in relation to water quality along rossetta branch, river nile, egypt. The egyptian journal of experimental biology (Zoology), 7: 223-233.

Awad, S., El Fakharany, M. and Hagran, N. (2015). Environmental impact on water resources at the northwestern part of the Nile Delta, Egypt. Journal of American Science, 11: 1-11.

Camargo, J.A., Alonso, A. and Salamanca, A. (2005). Nitrate toxicity to aquatic animals: A review with new data for freshwater invertebrates. Chemosphere, 58: 1255-1267.

Eaton, A., Clesceri, L.S., Rice, E.W., Greenberg, A.E .and Franson, M. (2005). APHA: Standard methods for the examination of water and wastewater. Centennial Edition., APHA, AWWA, WEF, Washington, DC.

Erdem, M., Altundoğan, H. and Tümen, F. (2004). Removal of hexavalent chromium by using heat-activated bauxite. Minerals Engineering, 17: 1045-1052.

Feng, C., Sugiura, N., Shimada, S. and Maekawa, T. (2003). Development of a high performance electrochemical wastewater treatment system. Journal of hazardous materials, 103: 65-78.

Foglar, L., Briški, F., Sipos, L. and Vuković, M., (2005). High nitrate removal from synthetic wastewater with the mixed bacterial culture. Bioresource Technology, 96: 879-888.

Gad, N.S., (2005). Impact of environmental pollution in the southern region of lake manzalah egypt on some biochemical parameters of tilapia zillii. Journal of Egyptian German Society of Zoology, 48: 279.

Hassanein, A., Abdelrahim, K., Sabry, Y., Ismael, M. and Abd El-Azeiz, H. (2013). Physicochemical and microbiological studies of river nile water in sohag governorate. J Environ Stud, 10: 47-61.

Hilal, N., Al-Zoubi, H., Darwish, N., Mohamma, A. and Arabi, M.A. (2004). A comprehensive review of nanofiltration membranes: Treatment, pretreatment, modelling, and atomic force microscopy. Desalination, 170: 281-308.

Huang, L., Li, L., Dong, W., Liu, Y. and Hou, H. (2008). Removal of ammonia by oh radical in aqueous phase. Environmental science & technology, 42: 8070-8075.

Iram, S., Ahmad, I., Ahad, K., Muhammad, A., & Anjum, S., (2009). Analysis of pesticides residues of Rawal and Simly Lakes. Pakistan Journal of Botany, 41(4), 1981– 1987.

Jensen, J.N. and Johnson, J.D. (1989). Specificity of the dpd and amperometric titration methods for free available chlorine: A review. Journal (American Water Works Association): 59-64.

Khairy, H.M., Shaltout, K.H., El-Sheekh, M.M. and Eassa, D.I., (2015). Algal diversity of the mediterranean lakes in egypt. International Conference on Advances in Agricultural, Biological & Environmental Sciences (AABES-2015) July 22-23, London (UK).

Kim, Y.M., Kim, S.J., Kim, Y.S., Lee, S., Kim, I.S. and Kim ،J.H. (2009). Overview of systems engineering approaches for a large-scale seawater desalination plant with a reverse osmosis network. Desalination, 238: 312-332.

Li, M., Feng ،C., Zhang, Z., Liu, X., Ma, W., Xue, Q. and Sugiura, N. (2011). Optimization of electrochemical ammonia removal using box–behnken design. Journal of electroanalytical chemistry, 657: 66-73.

Moghazy, H., Saleh, O., Rashwan, I. and El Tahan, N. (2015). Water management of meet yazied canal, Kafr El-shiekh governorate. Alexandria Engineering Journal 54 (4): 1193–1205

Mook, W., Chakrabarti, M., Aroua, M., Khan, G., Ali, B., Islam, M. and Hassan, M.A. (2012). Removal of total ammonia nitrogen (tan), nitrate and total organic carbon (toc) from aquaculture wastewater using electrochemical technology: A review. Desalination, 285: 1-13.

Nora'aini, A., Mohammad, A.W., Jusoh, A., Hasan, M., Ghazali, N. and Kamaruzaman, K.(2005). Treatment of aquaculture wastewater using ultra-low pressure asymmetric polyethersulfone (pes) membrane. Desalination, 185: 317-326.

Osman, A.G. and Kloas, W.(2010) Water quality and heavy metal monitoring in water, sediments, and tissues of the african catfish clarias gariepinus (burchell, 1822) from the river nile, egypt. Journal of Environmental Protection, 1: 389-400

Singh, K.P., Mohan, D., Singh, V.K. and Malik, A. (2005). Studies on distribution and fractionation of heavy metals in gomti river sediments - a tributary of the ganges, India. Journal of hydrology, 312: 14-27.

Sumino, T., Isaka, K., Ikuta, H., Saiki, Y. and Yokota, T. (2006). Nitrogen removal from wastewater using simultaneous nitrate reduction and anaerobic ammonium oxidation in single reactor. J. bioscience and bioengineering, 102: 346-351.

التباين الموسمي لموارد المياه ومدى ملاءمتها لإنتاج مياه الشرب

***اسماء الرشيدي، راتب يوسف، صافيناز فرفور، ابرهيم موسي**

قسم التكنولوجيا الحيوية البيئية، ☆ معهد الهندسة الوراثية والتكنولوجيا الحيوية، جامعة مدينة السادات، مصر

الملخص :

من المفترض أن تكون الموارد المائية عالية التلوث ومعالجة مياه الشرب واحدة من أهم قضايا صحة الإنسان. تواجه قناتان رئيسيتان في مدينة سيدي سالم بمحافظة كفر الشيخ تتعرضان لتقلبات نوعية. تهدف هذه الدراسة إلى التحقق من نقل ومصير الأمونيا القابلة للذوبان في الموارد المائية من خلال دراسة التغيرات الموسمية والمكانية للخصائص الفيزيائية الكيميائية. تم أخذ عينات اسبوعياً لإجراء الفحوصات الكيميائية، الفيزيائية والميكروبيولوجية. أظهرت النتائج أن مصدر مياه الأم هو المسؤول الرئيسي عن تلوث المياه وليس الأنشطة البشرية القريبة من القناة. قناة يزيد أقل تلوثا من قناة البحر في جميع معايير نوعية المياه باستثناء التعكر. وكان انخفاض مستوى المياه في مواسم الشتاء له تأثير كبير مع انخفاض جودة المياه في كلتا القناتين. وفي نفس الوقت، يجب اعتبار مياه الصرف الناتجة عن صناعات تربية الأحياء المائية جزءًا من خطة عامة متكاملة لإدارة مياه الصرف الصحي. ولذلك ، ينبغي تطوير علاجات مختارة وتقنيات فعالة من حيث التكلفة للسيطرة على انتشار التلوث في البيئة.