



## INCIDENCE OF SOME POLLUTANTS IN ISMAILIA CANAL AND USING DIFFERENT METHODS FOR REMOVAL.

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### ABSTRACT

This study was done in Ismailia canal. We chosen five sites to be studied, which have discharge from nearby factories so these sites were characterized by industrial pollution with either heavy metals and/or pesticide. Our study occur in two parts: part I determinations of physicochemical parameters in water and presences of heavy metal and pesticides in water. Part II: using different method for treating the polluted water to remove the pollutants. The result showed that there were no changes on Physico-chemical parameter of polluted water before and after treatment. Cadmium, lead, iron and manganese present in different sites with different level. Some pesticide (Deltamethrin, Nicotine, Cyprodinil and Diazinon) present but not at all sites. The biological method ranked superior followed by chemical method then conventional method.

**Key word:** Heavy metal, pesticide, chemical precipitation, bioremediation

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### 1. INTRODUCTION

The River Nile is the life artery of Egypt. Throughout the known Egyptian history, the Nile had dominating influences on the economy, culture, public health, social life and political aspects (Abdel-Hamid et al., 1992). The metal industry represents about 50% of the total waste discharges and industrial effluents as well as agricultural and domestic sewages constitute a real threat to the aquatic ecosystems of River Nile (El-Matasseem 1987). The Physico-Chemical characteristics of the River Nile water have been rather widely monitored (e.g. Abdel Satar 1994, Elewa 1991) However, the long-term effects of heavy metal pollution on the river water quality at River Nile delta are poorly known. Heavy metals are among the most common environmental pollutants, and their occurrence in waters and biota indicate the presence of natural or anthropogenic sources. The main natural sources of metals

in waters are chemical weathering of minerals and soil leaching. The anthropogenic sources are associated mainly with industrial and domestic effluents, urban storm, water runoff, landfill, mining of coal and ore, atmospheric sources and inputs rural areas (Zarazua et al. 2006). Water pollution by trace metals is an important factor in both geochemical cycling of metals and in environmental health (Kabata-Pendias and Pendias 1992). The existence of heavy metals in aquatic environments has led to serious concerns about their influence on plant and animal life. River monitoring data can reflect a variety of point and non-point sources of pesticide contamination. Some of the non-point sources which have been documented include, atmospheric deposition, tile drainage, interflow and surface runoff (Bengston et al., 1990). At the field-scale though, surface runoff is thought to be one of the most significant

sources of pesticides in surface waters (Leonard, 1988). The presence of specific pesticides in surface waters is not only a function of their susceptibility to loss in surface run off but is also affected by pesticide usage volume and transport characteristics within surface water systems, and weather patterns ( Frank et al., 1991).

Traditional methods for the cleanup of pollutants usually involve the removal of unwanted materials through sedimentation, filtration and subsequent chemical treatment such as flocculation, neutralization and electro-dialysis before disposal. These processes may not guarantee adequate treatment of the effluent (Hardman et al., 1993). Moreover, they are often laborious and expensive, considering the volume of wastes released during the industrial production process. Various techniques have been employed for the treatment of metal bearing industrial effluents, which usually include precipitation, adsorption, ion exchange, membrane and electrochemical technologies but these techniques are expensive, not environment friendly and usually dependent on the concentration of the waste which are ineffective in very diluted solutions. Therefore, the search for efficient, eco-friendly and cost effective remedies for wastewater treatment has been initiated. It was only in the 1990s that a new scientific area developed that could help to recover heavy metals and it was bioremediation. The early reports described how abundant biological materials could be used to remove, at very low cost, even small amounts of toxic heavy metals from industrial effluents. The principle advantages of biological technologies for the removal of pollutants are they can be carried out in situ at the contaminated site, usually environmentally benign (no secondary pollution) and they are cost effective. Of the different biological methods, bioaccumulation and biosorption have been demonstrated to possess good potential to replace conventional methods

for the removal of metals (Malik, 2004). Bioaccumulation can be defined as the uptake of toxicants by living cells. The toxicant can transport into the cell accumulate intracellular, across the cell membrane and through the cell metabolic cycle (Malik, 2004). Conversely, biosorption can be defined as the passive uptake of toxicants by dead/inactive biological materials. Metal-sequestering properties of non-viable biomass provide a basis for a new approach to remove heavy metals when they occur at low concentrations (Volesky, 1990). The aim of this study is carried out to investigate the efficiency of different methods of water treatment (chemical, biological and conventional or traditional) to be at acceptable standard through. Determination of the physico-chemical parameters of the surface water. Presence of heavy metals and pesticide in the water before and after treatment.

## **2. MATERIAL AND METHODS**

### *2.1 Sampling.*

The technique of sampling was conducted according to (APHA 1971). Clean glass bottle of one liter capacity were used for each sample, the bottle washed firstly with some of river Nile then plunging it in an inverted position below the water surface. The bottle was turned until the neck points slightly upward and pushed forward horizontally in a manner away from the hand. Each sample was labeled and identified showing source, site and date of sampling. Water samples were collected from Ismailia canal from Shubra till Abu – Zaabal. We have samples from five different sites from each site we have 3 points of sampling. 1<sup>st</sup> 5 samples at the drainage of pollution ( A ), 2<sup>nd</sup> 5 samples away from 1<sup>st</sup> point by 500meter ( B ) and 3<sup>rd</sup> 5 samples away from 2<sup>nd</sup> point by 500 meter ( C ) Totally we have 75 water samples. Table (1).

### *2.2 Methods*

#### **2.2.1. PART I. SURVEY ON POLLUTED SURFACE WATER**

*2.2.1.1. Physico-chemical parameter of polluted surface water.* All the following analyses were carried out (to standard methods) for examination of polluted surface water before and after water treatment (APHA 1998). PH and electric conductivity (EC) were detected according to APHA 1998 and Jackson 1967. Total dissolved solids (TDS) according to (APHA 1998). Determination of major anion As Chloride, Sulphate, carbonate and bicarbonate according to Page et al 1982. Determination of major cations as Calcium and Magnesium using the EDTA titrimetric method according to (Eaton. et al 1995) and Potassium and sodium using the flame photometer model (ANA – 10B) according to (Page et al 1982)

*2.2.1.2. Determination of trace elements in polluted surface water samples.* Samples collected for heavy metal were preserved by adding concentrated nitric acid to (pH < 2) to avoid microbial reactions. Trace elements (cadmium (Cd), lead (Pb), iron (Fe), and manganese (Mn)) were measured using inductivity coupled plasma – optical emission spectrometry (ICP – ES) with ultra-sonic nebulizer (USN). This Nebulizer decrease instrumental detection limits by 10% the samples were filtered by filtration system through membrane filter of pore size 0.45 nm before analysis (APHA 1998)

*2.2.1.3. Detection of pesticide in polluted surface water samples:* Samples collected for pesticides were preserved by cooling in refrigerator to avoid microbial growth. Analysis by Gas Chromatography (GC) system (HP 5890 series II plus GC) coupled to a quadrupole mass spectrometer (HP 5989 B MS), this Nebulizer decrease instrumental detection limits by 10% the samples were filtered by filtration system through membrane filter of pore size 0.45 nm (APHA 1998).

## **2.2.2 PART II. POLLUTED SURFACE WATER TREATMENT**

*2.2.2.1 Polluted surface water treated by conventional method.* According to (Siriprapha, et al 2011) were in this method we used aluminum sulfate or Alum PH

value in water sample must be at 6.0 to achieve a great efficiency of alum. Adding aluminum sulfate at dose 400mg/l of polluted surface water then adjust PH at 6.0 then start mixing by rapid mixing (200 rpm/10min) then slow mixing at 45 rpm/30min and left for settling for 60 min ,filtrates then water samples were analyzed by using ICP- ES for trace elements and GC system for pesticide.

*2.2.2.2. Polluted surface water treated by chemical precipitation method:* According to (El Karamany, 2010). This method performed by using ferric chloride. PH value in water sample must be at 4.0 to achieve a great efficiency of metal ions removal. Adding ferric chloride at dose 200mg/l of polluted surface water (Sriwiriyarat and Jangkorn, 2009) then adjust PH at 4 starts mixing by rapid mixing at 180 – 200 rpm/1 – 3 min. followed by slow mixing at 20 – 40 rpm/30 – 50 min then left for settling for 35 – 45 min; filtrates water samples were analyzed by using ICP- ES for trace elements and GC system for pesticide.

*2.2.2.3. Polluted surface water treated by bioremediation method.* According to (Malekzadeh. et al 2002), where in this method we used *Pseudomonas areginosaum* bacteria this strain obtained from Animal Health Research Centre in Cairo. Firstly bacteria grow at specific media (pseudomonas selective media) for increase its count then, harvested by centrifugation at 4000 rpm for 20 min at 4 C and washed twice with distilled water. Freshly harvested bacterial cells were suspended in deionized water to a final concentration of 2.5 mg dry weight per milliliter. About 10 ml of the suspension was added to 40 ml of polluted surface water samples. Suspensions were centrifuged at 4000 rpm for 20 min 4C, after incubation for 1 h at room temperature, filtration by using bacterial filter after that measure the pollutant on water by using ICP – ES for trace elements and GC system for pesticide. For confirmation that the filtrate

was free from bacteria culturing the filtrate on pseudomonas selective media.

### 2.3 Statistical analysis

The data were analyzed for obtaining mean, standard deviation (SD) and statistical comparisons between means of different groups. The statistical analyses were done by one way ANOVA and DUNCAN test using SPSS program version 16. (Kirk 1982). P value < 0.05 was assumed for statistical significance.

## 3. RESULT

### 3.1 PART I. SURVEY OF POLLUTED WATER.

Regarding to the physicochemical characters of the collected surface water samples were slight brown in color especially near the discharge of the factories and this color fade out when get away from the discharge point. The other chemical parameters of polluted surface water samples from Ismailia canal are somewhat similar to each other. Table (2, 3). PH of all samples is neutral from 6.5-7.5 that within permissible limit of the WHO 2011. The electric conductivity values of the all samples are similar that increased slightly in water samples than permissible limit. The total solids were above the permissible limit. While the result of determination of major anion in water samples such as (chloride, sulphate, carbonate and bicarbonate) and the result of major cations in water samples such as (sodium, potassium, calcium and magnesium) which are all were within permissible limits.

### 3.2. Part ii. Polluted surface water and its treatment.

**3.2.1. Heavy Metals.** Regarding to The level of [Cadmium (Cd), Iron (Fe), Lead (Pb), Manganese (Mn) in the water samples before treatment. Our result showed that the cadmium level was present at all sites of sampling {0.69, 0.43, 0.023, 0.0269, 0.043, 0.023, 0.069, 0.043, 0.023, 0.053, 0.039, 0.013, 0.052, 0.028, and

0.060} above the permissible limit as showed in table (4). Iron level present at all sites sampling

{0.64,0.421,0.112,0.549,0.24,0.056,0.322, 0.119,0.054,0.188,0.084,0.0318,0.103,0.043,0.019}

within or below permissible limits as cleared in table (5). Lead level present at sites of samplings

{0.42,0.136,0.056,0.155,0.091,0.051,0.06, 0.043,0.023,0.14,0.093,0.053,0.07,0.043,0.02}

above and within the permissible limits as showed in table (6). Furthermore Manganese present with level

{0.236,0.083,0.040,0.143,0.03,0.049,0.143 ,0.083,0.049,0.143,0.083,0.049,0.136,0.083,0.041}

above the permissible limit as cleared in table (7) when compared with slandered values that cleared in table (12) .

**3.2.2. Pesticides.** Regarding to pesticides presences in polluted surface water the results showed that Deltamethrin was detected at site 2, 3, 4, 5 and absent in site 1 after treatment by alum it absent at sites 2, 3 but still present at sites 4, 5 while by treatment with bioremediation and ferric chloride it became absent in comparison with polluted surface water result before treatment Table (8). Concerning to Nicotine, the result showed that it present at site 1, 4, 5 and absent in sites 3, 2. After treatment by alum nicotine was absent at sites 1, 5 still present at site 4 but after treatment with bioremediation and ferric chloride it became absent at all sites in comparison with polluted surface water result before treatment. Table (9). Mean while, Cyprodinil present at site 1 , 4 and absent in other sites 2 ,3 , 5 After treatment by alum ,bioremediation and ferric chloride it became absent in all sites in comparison with polluted surface water result before treatment Table (10). Moreover, Diazinon was present at site 1, 3 and absent in sites 2, 4, 5. After treatment by alum it absent at site 1 still present at site 3 but after treatment with bioremediation and ferric chloride it became absent in comparison with polluted surface water result before treatment. Table (11).

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**Table (1):** Illustrate location, sites, number total number of water samples used and design of the experiment.

4. Samples 5. Sites	Water samples						Total No.	Design of experiments
	First site	No. of sample	Second site	No. of sample	Third site	No. of sample		
Delta steel cables company	At the drainage point (A)	5	500 meters away from the drainage point (B)	5	1000 meter away from the drainage point (C)	5	Totally we have 75 water samples	I- <i>Before water treatment</i>
Nile company for oil and detergents		5		5		5		1- physicochemical parameters
Gas pipeline companies- petrogas		5		5		5		2- Presence of heavy metal
Abu Zaabal fertilizer company		5		5		5		3- Presence of pesticide
Egyptian alum company		5		5		5		II- <i>water treatment by Alum,</i> Ferric chloride and Pusedomonse bacteria
								III- <i>After water treatment</i>
								1- physicochemical parameters
								2- Presence of heavy metal
								3- Presence of pesticide

Table (2): The physic chemical parameters of polluted surface water from different sites on Ismailia canal before treatment:

Parameters	W.H.O. 2011	Site 1			Site 2			Site 3			Site 4			Site 5		
	P.L.	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
PH	6.5-8.5	6.87± 0.4	6.86± 0.9	6.79± 0.9	7.10± 0.4	7.28± 0.4	7.08 ±0.4	7.14± 0.6	7.30± 0.6	7.41±1 .5	7.47± 1.5	7.40± 0.4	7.60± 1.5	7.10± 0.4	7.04± 0.6	7.05± 0.6
EC ms/cm	0.3	0.43± 0.3	0.34± 0.4	0.34± 0.9	0.33± 0.3	0.29± 0.3	0.34± 0.3	0.35± 0.6	0.35± 0.6	0.35±0 .6	0.35± 1.5	0.35± 0.6	0.35± 1.5	0.35± 1.5	0.34± 0.4	0.35± 1.5
Total solid mg/l	500	1277 ±1.5	1218 ±0.3	1034 ±0.3	812± 0.3	791± 0.7	717± 0.4	993± 1.5	882± 0.4	790±1. 5	577± 1.5	418± 0.3	334± 0.3	1112 ±0.3	791± 0.7	617± 0.4
Calcium mg/l	40	37.88 ±0.3	39.4± 1.5	38.81 ±0.9	39.1± 0.7	38.6± 0.3	37.7± 0.3	39.1± 0.3	38.1± 0.3	39.0±0 .3	39.3± 0.4	38.9± 0.3	37.2± 0.3	38.5± 0.4	39.01 ±1.5	37.9± 1.5
Magnesium mg/l	12.83	12.35 ±0.4	9.55± 0.3	12.48 ±1.5	12.1± 0.7	13.1± 1.5	11.8± 0.4	11.6± 0.6	11.8± 0.3	11.9±0 .3	11.9± 0.4	11.6± 0.3	12.0± 0.3	11.6± 0.3	11.18 ±0.4	12.1± 0.6
Sodium mg/l	32	20.66 ±1.5	20.7± 0.3	20.98 ±0.7	20.8± 0.7	19.2± 0.3	19.2± 0.4	19.8± 0.3	19.5± 0.3	21.3±1 .5	21.0± 0.3	21.8± 0.3	21.2± 0.3	21.1± 0.4	21.30 ±0.6	20.0± 1.5
Potassium mg/l	8	7.61± 1.5	7.05± 0.3	7.19± 1.5	7.48± 0.3	6.65± 0.3	7.37± 1.5	7.56± 1.5	6.92± 0.4	6.20±1 .5	7.95± 0.3	6.93± 0.3	7.33± 0.3	7.94± 0.6	6.82± 0.6	6.53± 1.5
Chloride mg/l	39	25.00 ±0.9	25.4± 0.3	24.00 ±0.7	25.9± 0.4	24.2± 0.4	24.2± 0.3	23.5± 0.6	24.3± 0.3	22.9±1 .5	22.4± 0.3	24.3± 0.3	22.5± 0.3	24.7± 0.3	22.75 ±0.3	24.5± 0.6
Bicarbonate mg/l	150	156± 1.5	134± 0.7	143± 0.3	147. ±0.4	152± 0.3	148± 0.3	155. ±1.5	137. ±0.3	142. ±0.3	159± 1.5	146. ±0.6	144. ±0.3	150. ±0.6	153.4 ±0.3	140± 1.5
Sulphide mg/l	52	29.4± 1.5	31.4± 0.3	29.6± 0.4	31.8± 0.4	27.7± 0.3	26.5± 1.5	32.3± 0.3	28.3± 0.4	27.4±0 .3	32.6± 0.6	31.1± 0.4	31.0± 0.3	32.9± 1.5	28.95 ±0.6	25.4± 1.5
Carbonate mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Mean with different letters at the same row differ significant ( $P < 0.05$ ).

Sites 1, 2, 3, 4&5: Sites of collected samples from Ismailia canal.

A, B, C: Distance of collected samples from the source of pollution.

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Table (3): Total solids of polluted surface water from different sites on Ismailia canal after treatment:

Sites & group Samples	Site 1			Site 2			Site 3			Site 4			Site 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
P. S.W	1277	1218	1034	812±	791±	717±	993±	882±	790±	577±	418±	334±	1112	791±	617±
	±1.5	±0.3	±0.3	0.3	0.7	0.4	1.5	0.4	1.5	1.5	0.3	0.3	±0.3	0.7	0.4
P.S.W treated Alum	1077	1018	934±	612±	591±	517±	793±	622±	590±	427±	358±	234±	912±	791±	517±
	±1.5	±0.3	0.3	0.3	0.7	0.4	1.5	0.4	1.5	1.5	0.3	0.3	0.3	0.7	0.4
P. S.W treated Ferric chloride	977±	918±	734±	452±	391±	217±	593±	382±	2190	377±	318±	284±	752±	571±	217±
	1.5	0.3	0.3	0.3	0.7	0.4	1.5	0.4	±1.5	1.5	0.3	0.3	0.3	0.7	0.4
P.W.S treated Bioremediation	777±	618±	534±	212±	191±	117±	393±	262±	190±	257±	218±	194±	412±	291±	117±
	1.5	0.3	0.3	0.3	0.7	0.4	1.5	0.4	1.5	1.5	0.3	0.3	0.3	0.7	0.4

Table (4): Cadmium level (ppm) in surface water from different sites of source of pollution in Ismailia Canal:

Sites & group Samples	Site 1			Site 2			Site 3			Site 4			Site 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
P. S.W	0.690	0.430	0.023	0.269	0.043	0.023	0.069	0.043	0.023	0.053	0.039	0.013	0.052	0.028	0.060
	±0.1 <sup>a</sup>	±0.3 <sup>a</sup>	±0.4 <sup>a</sup>	±0.2 <sup>a</sup>	±0.5 <sup>a</sup>	±0.4 <sup>a</sup>	±0.2 <sup>a</sup>	±0.5 <sup>a</sup>	±0.4 <sup>a</sup>	±0.1 <sup>a</sup>	±0.8 <sup>a</sup>	±0.5 <sup>a</sup>	±0.4 <sup>a</sup>	±0.1 <sup>a</sup>	±0.8 <sup>a</sup>
P.S.W treated Alum	0.590	0.092	0.011	0.145	0.028	0.015	0.041	0.025	0.010	0.049	0.027	0.013	0.043	0.021	0.013
	±0.2 <sup>a</sup>	±0.1 <sup>b</sup>	±0.2 <sup>b</sup>	±0.3 <sup>a</sup>	±0.07 <sup>a</sup>	±0.1 <sup>a</sup>	±0.1 <sup>a</sup>	±0.1 <sup>a</sup>	±0.8 <sup>a</sup>	±0.5 <sup>a</sup>	±0.1 <sup>a</sup>	±0.4 <sup>a</sup>	±0.4 <sup>a</sup>	±0.9 <sup>a</sup>	±0.8 <sup>b</sup>
P. S.W treated Ferric chloride	0.248	0.023	0.010	0.093	0.018	0.007	0.044	0.027	0.007	0.039	0.025	0.010	0.043	0.020	0.008
	±0.5 <sup>b</sup>	±0.1 <sup>c</sup>	±0.48 <sup>b</sup>	±0.1 <sup>a</sup>	±0.08 <sup>a</sup>	±0.04 <sup>b</sup>	±0.4 <sup>a</sup>	±0.4 <sup>a</sup>	±0.7 <sup>b</sup>	±0.3 <sup>a</sup>	±0.4 <sup>a</sup>	±0.7 <sup>a</sup>	±0.1 <sup>a</sup>	±0.2 <sup>a</sup>	±0.1 <sup>c</sup>
P.W.S treated Bioremediation	0.060	0.014	0.007	0.033	0.014	0.008	0.025	0.013	0.004	0.024	0.017	0.006	0.019	0.004	0.008
	±0.4 <sup>c</sup>	±0.4 <sup>c</sup>	±0.8 <sup>c</sup>	±0.6 <sup>a</sup>	±0.5 <sup>a</sup>	±0.01 <sup>b</sup>	±0.1 <sup>a</sup>	±0.8 <sup>b</sup>	±0.4 <sup>b</sup>	±0.4 <sup>a</sup>	±0.5 <sup>a</sup>	±0.4 <sup>b</sup>	±0.1 <sup>b</sup>	±0.9 <sup>b</sup>	±0.2 <sup>c</sup>

Mean with different letters at the same row differ significant ( $P < 0.05$ ).

Sites 1, 2, 3, 4&5: Sites of collected samples from Ismailia canal.

A, B, C: Distance of collected samples from the source of pollution

P.S.W: polluted surface water

Table (5): Iron Level (ppm) in surface water from different sites of source of pollution in Ismailia Canal:

Sites &group Samples	Site 1			Site 2			Site 3			Site 4			Site 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
P. S.W	0.64 ±0.1 <sup>a</sup>	0.421 ±0.3 <sup>b</sup>	0.112 ±0.3 <sup>c</sup>	0.549 ±0.2 <sup>a</sup>	0.24 ±0.6 <sup>b</sup>	0.056 ±0.2 <sup>c</sup>	0.322 ±0.5 <sup>a</sup>	0.119 ±0.1 <sup>b</sup>	0.054 ±0.4 <sup>c</sup>	0.188 ±0.4 <sup>a</sup>	0.084 ±0.1 <sup>b</sup>	0.0318 ±0.3 <sup>c</sup>	0.103 ±0.2 <sup>a</sup>	0.043 ±0.1 <sup>b</sup>	0.019 ±0.8 <sup>c</sup>
P.S.W treated Alum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
P. S.W treated Ferric chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
P.W.S treated Bioremediation	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table (6): Lead level (ppm) in surface water from different sites of source of pollution in Ismailia Canal:

Sites &group Samples	Site 1			Site 2			Site 3			Site 4			Site 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
P. S.W	0.420 ±0.1 <sup>a</sup>	0.136 ±0.2 <sup>b</sup>	0.0566 ±0.4 <sup>c</sup>	0.155 ±0.5 <sup>a</sup>	0.091 ±0.4 <sup>b</sup>	0.051 ±0.5 <sup>c</sup>	0.06 ±0.1 <sup>a</sup>	0.043 ±0.4 <sup>b</sup>	0.023 ±0.5 <sup>c</sup>	0.14 ±0.1 <sup>a</sup>	0.093 ±0.4 <sup>b</sup>	0.053 ±0.5 <sup>c</sup>	0.07 ±0.1 <sup>a</sup>	0.043 ±0.4 <sup>b</sup>	0.02 ±0.5 <sup>c</sup>
P.S.W treated Alum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
P. S.W treated Ferric chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
P.W.S treated Bioremediation	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Mean with different letters at the same row differ significant ( $P < 0.05$ ).

Sites 1, 2, 3, 4&5: Sites of collected samples from Ismailia canal. P.S.W. polluted surface water

ND: not detected. A, B, C: Distance of collected samples from the source of pollution



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Table (7): Manganese level (ppm) in surface water from different sites of source of pollution in Ismailia Canal:

Sites &group Treatment	Site 1			Site 2			Site 3			Site 4			Site 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
P. S.W	0.236 ±0.1 <sup>a</sup>	0.083 ±0.2 <sup>b</sup>	0.040 ±0.3 <sup>c</sup>	0.143 ±0.1 <sup>a</sup>	0.083 ±0.4 <sup>b</sup>	0.049 ±0.7 <sup>c</sup>	0.143 ±0.1 <sup>a</sup>	0.083 ±0.4 <sup>b</sup>	0.049 ±0.7 <sup>c</sup>	0.143 ±0.1 <sup>a</sup>	0.083 ±0.4 <sup>b</sup>	0.049 ±0.7 <sup>c</sup>	0.136 ±0.4 <sup>a</sup>	0.083 ±0.2 <sup>b</sup>	0.041 ±0.1 <sup>c</sup>
P.S.W treated Alum	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
P. S.W treated Ferric chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
P.W.S treated Bioremediation	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table (8): Deltamethrin level (ppm) in surface water from different places of source of pollution in Ismailia Canal:

Sites &group Samples	Site 1			Site 2			Site 3			Site 4			Site 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
P. S.W	- ve	-ve	-ve	+ ve	+ve	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve
P.S.W treatedAlum	- ve	-ve	-ve	-ve	-ve	-ve	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve	-ve	-ve	-ve
P. S.W treated Ferric chloride	- ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve
P.W.S treated Bioremediation	- ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve

Mean with different letters at the same raw differ significant ( $P < 0.05$ ).

Sites 1, 2, 3, 4&5: Sites of collected samples from Ismailia canal.

A, B, C: Distance of collected samples from the source of pollution

Table (9): Nicotine level (ppm) in surface water from different places of source of pollution in Ismailia Canal:

Sites &group Samples	Site 1			Site 2			Site 3			Site 4			Site 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
P. S.W	+ ve	+ ve	+ ve	+ve	+ve	+ve	-ve	-ve	-ve	+ ve	+ ve	+ ve	+ ve	+ ve	+ ve
P.S.W treated Alum	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	+ ve	+ ve	+ ve	-ve	-ve	-ve
P. S.W treated Ferric chloride	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve
P.W.S treated Bioremediation	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve

Table (10) : Cyprodinil level (ppm) in surface water from different places of source of pollution in Ismailia Canal:

Sites &group Samples	Site 1			Site 2			Site 3			Site 4			Site 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
P. S.W	+ ve	+ve	+ve	+ve	+ve	+ve	-ve	-ve	-ve	+ve	+ve	+ve	-ve	-ve	-ve
P.S.W treated Alum	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve
P. S.W treated Ferric chloride	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve
P.W.S treated Bioremediation	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve

Mean with different letters at the same row differ significant ( $P < 0.05$ ).

Sites 1, 2, 3, 4&5: Sites of collected samples from Ismailia canal.

A, B, C: Distance of collected samples from the source of pollution

Incidence of some pollutants in Ismailia canal and using different methods for removal.

Table (11): Diazinon level (ppm) in surface water from different places of source of pollution in Ismailia Canal:

Sites &group Samples	Site 1			Site 2			Site 3			Site 4			Site 5		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
P. S.W	+ve	+ve	+ve	-ve	-ve	-ve	+ve	+ve	+ve	-ve	-ve	-ve	-ve	-ve	-ve
P.S.W treated Alum	+ve	+ve	+ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve
P. S.W treated Ferric chloride	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve
P.W.S treated Bioremediation	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve

Table (12): Standard level of trace elements in drinking water:

Parameter	Unit	Egyptian Law 48/1982	W.H.O 2011	CWQGS 2002
Cadmium	mg/ L	0.01	0.005	0.005
Iron	mg/ L	< 1	1	0.3
Lead	mg/ L	0.05	0.01	0.01
Manganese	mg/ L	0.05	0.05	0.05

Egyptian Law 48/1982: Egyptian Law for protection of the River Nile and water ways from pollution.

W.H.O. 2011: World Health Organization

CWQGS 2002: Canadian water quality guideline for protection of aquatic life.

## 6. DISCUSSION

The result tabulated in tables (2, 3) pH of all samples is neutral from 6.5-7.5 that within permissible limit of the WHO 2011. The electric conductivity values of the all samples are similar that increased slightly in water samples than permissible limit. The total solids were above the permissible limit agree with Tas (2006) who described the analysis of surface waters collected from one station in reservoir in Turkey. This may be attributed to the huge amounts of raw sewage, agricultural and industrial wastewater discharged into the canal (Abdel-Moati and El-Sammak, 1997). While the result of determination of major anion in water samples such as (chloride, sulphate, carbonate and bicarbonate) and the result of major cations in water samples such as (sodium, potassium, calcium and magnesium) which are all were within permissible limits. Our result agreed with (Elewa 2010). There was no significant change on physic chemical parameters of polluted surface water before and after treatment. Our result agreed with (Batayneh *et al.*, 2011) who studied the water quality in Yarmouk basin and its suitability for irrigation or drinking water.

Heavy metals are one of the most important groups of pollutants, so it is necessary to monitor the level of heavy metals residues to evaluate the acceptability to human consumption (Jehan and Abd El- Aziz 2002). The results tabulated in tables (4, 5, 6, 7), may be attributed to the cumulative nature of heavy metals especially in the sediment. Small proportion of metals remains in the soluble fraction, while the major fraction is removed and becomes associated with the suspended or bottom sediments (Abd El- Nasser *et al.*, 1996). The main source of metals was the mixed discharge from gas petrochemical compounds (Barrera *et al* 2004). The toxic heavy metal becomes a potential hazard for man, aquatic birds and mammals (Abd El-Nasser *et al.*, 1996). The elevated cadmium level in surface water may be as waste of

electric batteries, electronic components and nuclear reactors (Friberg *et al.*, 1986; Ros & Slooff, 1987) as Cadmium metal is used mainly as an anticorrosive, electroplated onto steel. Cadmium sulfide and selenide are commonly used as pigments in plastics and it can be correlated well with the industrial wastes, gasoline consumption and as one of fertilizer manufacturing industrial effluents (Abd El Nasser *et al.*, 1996, Zhang *et al.*, (2004)). The elevated lead level in surface water correlated well with the industrial wastes and leaded gasoline consumption (Abd El Kader *et al.*, 1993). Beliles (1979) mentioned that the major sources for manganese in air and water are iron and steel manufacturing and the burning of diesel fuel in the motor cars. Regarding to The level of (Cadmium (Cd), Iron (Fe), Lead (Pb), Manganese (Mn) in the water samples after treatment by Aluminum sulfite (Alum), chemical precipitation (Ferric chloride) and by Bioremediation (by *Pseudomonas* bacteria). Our result showed that By Aluminum sulfite (Alum). Cadmium level significantly decreased at all sites but still above the permissible limit in comparison with cadmium level in polluted surface water. Iron, lead and manganese level are present with undetectable limits at all sites of sampling so it significantly decreased when compared with polluted surface water these result agree with Mahmood, *et al* 2011. By Chemical Precipitation Ferric chloride, cadmium level significantly decreased at all sites but still above the permissible limit in comparison with cadmium level in polluted surface water and none significantly decrease when compared with Alum treatment but these level still above the permissible limits. Iron, lead and Manganese level are present with undetectable limits at all sites of sampling so it significantly decreased when compared with polluted surface water and polluted surface water treated with Alum. Duan and Gregory, 2003 mentioned that Fe (III) has limited solubility, because of the

precipitation of an amorphous hydroxide, which can play a very important role in practical coagulation and flocculation processes. More importantly in practice, hydroxide precipitation leads to the possibility of sweep flocculation, in which contaminant particles become enmeshed in the growing precipitate and thus are effectively removed. These result agreed with Ahalya et al., (2003). The ferric chloride produces good coagulant than Alum but it gives chemical sludge. By Bioremediation. cadmium level significantly decreased at all sites if compared with cadmium level in polluted surface water and after treatment with Alum and with ferric chloride treatment but these level still above the permissible limits. Iron, lead and Manganese level are present with un detectable limits at all sites of sampling so it significantly decreased when compared with polluted surface water and polluted surface water treated with Alum and Ferric chloride. Doyle et al., (1980) explained that the bacterial cell wall is the first component that comes into contact with metal ions where the solutes can be deposited on the surface or within the cell wall structure. Since the mode of solute uptake by dead/inactive cells is extracellular, the chemical functional groups of the cell wall play vital roles in biosorption. Our result showed a significant decrease in level of all elements in different methods of treatment where bioremediation are more effective followed by ferric chloride then alum. These result agree with (Malekzadeh, et al 2002, Mahmood, et al 2011 and Nabi Bidhendi, et. al. 2007). The biggest problem in the chemical treatment of water is the selection of the chemical which must be added to the water in order to precipitate the dispersed pollutants. Metal precipitation is primarily dependent upon two factors, the concentration of the metal, and the PH of the water. Heavy metals are usually present in water in diluted quantities and at neutral or acidic PH values. Metals enter treatment system; they are in stable, dissolved

aqueous form and are unable to form solids. The goal of metal treatment by precipitation in adjusts the PH of water so that the metal will form insoluble precipitate. So they can easily be removed from the water (Citulski et al 2009). Precipitation of metals is achieved by the addition of coagulants such as alum, lime, iron salts and other organic polymers. The large amount of sludge containing toxic compounds produced during the process is the main disadvantage. (Ahalya et al., 2003). The above techniques can be summarized as expensive, not environment friendly as they increase the total dissolved salt content in treated water so increase the desalination costs and usually dependent on the concentration of the waste. The result also described by *Pseudomonas* exhibited specificity for accumulating most of heavy metals as Pb, Cd, and Cu and pesticides types. Specificity for a given metal ion by a bacterial species has been reported by other investigators (Wong & So 1993). (Lal *et al.*, 1996) assessed that biological methods were preferable than chemical treatment as biological method is cost-effective as well as environmentally sustainable and also socially acceptable.

Pesticides result agreed with result of Seema (2004) who studied that the ability of *pseudomonas* strains in biodegradation of pesticide types. these may be indicate poor water quality that might be produced due to proximity to the biologic influences, polluted point sources (industrial and sewage) or non-point ones (agricultural waste water) (Elewa 2010). It can be concluded that there is pollution by heavy metals and pesticide in different sites in Ismailia canal. We use different methods for polluted surface water treatment these methods are traditional method by using Aluminum sulfite or Alum, chemical precipitation method by using Ferric chloride and Biological method by using *Pseudomonas* bacteria or Bioremediation our result showed that the best method for polluted surface water treatment is biological method or bioremediation.

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### معدل تواجد الملوثات في ترعة الاسماعيلية واستخدام طرق مختلفة للتخلص منها

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#### الملخص العربي

أجريت هذه الدراسة في ترعة الاسماعيلية وذلك باختيار خمس مناطق تتميز بأنها مصب للمصانع المجاورة للترعة لذلك فهي تتميز بوجود تلوث صناعى مثل المعادن الثقيلة والمبيدات وتم استخدام طرق مختلفة لعلاج هذه المياه الملوثة للتخلص من الملوثات التي توجد بها. قامت الدراسة على جزئين: 1- الجزء الأول، الكشف عن وجود المعادن الثقيلة والمبيدات في المياه السطحية وذلك بتحليل الخواص الفيزيائية والكيميائية في المياه. 2- الجزء الثاني. معالجة المياه الملوثة بالطرق المختلفة وهي: الطريقة التقليدية باستخدام الشبة الطريقة الكيماوية باستخدام كلوريد الحديدك. الطريقة البيولوجية باستخدام بكتيريا السيدومونس. ويمكن تلخيص النتائج فيما يلي: 1- الجزء الأول. من حيث قياس الخواص الفيزيائية والكيماوية للمياه قبل وبعد العلاج وجد أنها لا تتغير الا في حالة نسبة المواد الصلبة نجد أنها تزيد بعد العلاج بالطرق المختلفة. 2- الجزء الثاني من حيث وجود المعادن الثقيلة وجد ان الكاديوم والرصاص والحديد والمنجنيز موجودين في كل المناطق ولكن بتركيزات مختلفة. اما من حيث وجود المبيدات وجد أنها توجد في بعض المناطق. أما عن كفاءة العلاج بالطرق المختلفة وجد ان العلاج بالشبة أقل تأثيرا من العلاج بكلوريد الحديدك اقل تأثيرا من العلاج بالبكتيريا.

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