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Monitoring of Pollutants in Waste Water in Some Egypt Drains

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ABSTRACT

This study was conducted to investigate the concentrations of heavy metals and pesticides in waste water from three main drains in Egypt . The drains were Belbais drains , Baher EL – Baker drain and EL – Kalubia drain . Samples were taken from the end of each drain monthly for 12 months from the period of April 2015 to March 2016 to determine heavy metals and for the pesticides residues at February 2016 and Co , Cr , Fe , Mn , B , Pb , Cd , Ni , Zn using flame atomic absorption spectrometry . Results show that the concentrations of some heavy metals exceeded their respective permissible limits in water samples .The average of concentrations for (zinc , manganese and cadmium) were 0.72 , 0.44, 0.02 mg/ L in EL – Kalubia drain and 0.7 ,0.38 , 0.02 mg/ L in Belbais drain, respectively , while in Baher EL – Baker drain were 0.54 and 0.05mg / L for zinc and cadmium ,respectively . These concentrations were exceeded compared with the recommended maximum concentrations for irrigation . The corresponding figures were different in pesticides residues . Results show that the concentrations of Endosulfan 11 were 0.06 ug / g in Belbais drain ,Endrin were 2.12 ug / gm in EL – Kalubia drain and the Trichlorfen pesticide were 0.01 , 0.19 ug/g in EL – Kalubia and Baher EL – Baker drains, respectively.

Keywords : monitor – heavy metals – pesticides – waste water Egypt drains

INTRODUCTION

The heavy metals concentration is becoming more important in urban areas soils .People are using waste water in agriculture fields which is no clean water source (Bambara *et al*. 2015)

The accumulation of heavy metals in the soil can be cause by waste water irrigation (Jayadev and Puttain 2013). there is relation between the use of sludge and contaminated water on buildup of heavy metals in soil. The use of pesticide and chemical fertilizer alongside sludge in the farms is an additional reason for transferring Cr , Ni , and Pb from soil to edible parts of the crops (Muamar *et al*. 2014) .

In order to enhance the agricultural crop yields , pesticides have been used to control weeds, insects and fungi in a wide range of application. Several million tons of organic and inorganic chemicals with antimicrobial and insecticidal properties are added annually into soil and their environment (Vishnu *et al*. 2015). Pesticides have become an essential part of modern agriculture. Pesticides are used several times during one season and a part always reaches the soil and irrigation water .

The wide use of pesticides has created numerous problems, including the pollution of the environment specially water . After pesticides are applied to the target areas , pesticide residues are removed from applications by rinsing with water which results in the formation of a toxic waste water that can adversely affect to people , pests and wild life (Centner,2009;Ridgway *et al*. 1998).The ecological studies detected the unsafe disposal of pesticides can be severe depending on the type of pesticide and the amount contained in the waste water (Al - Hallals *et al*. 2012).

Therefore , the present study aims to monitor and determine the concentrations of heavy metals and pesticides in waste water.

MATERIALS AND METHODS

Study area

Lands of East Delta drain almost completely into Manzala lake which is connected to the Mediterranean sea . A large area is drained by Baher EL – Baker main drain system , which flows to Manzala lake.

Samples of water were collected monthly for 12 months, from the period of April 2015 to March 2016 . The samples were taken from three locations which the end of Belbais drain , the end of EL – Kalubia drain and the end of Baher EL – Baker drain.

Samples and sampling technique

A volume of 4 L was collected in each location at each monthly sampling and filtered immediately and kept in polyethylene bottles under 4 C^0 till detailed analysis .

The heavy metals such as Iron (Fe) , Manganese (Mn) ,Zinc (Zn) , Cobalt (Co) , Nickel (Ni) , Cadmium (Cd) , Chromium (Cr) , Brome (Br) and Lead (Pb) were analyzed in water using the method of Kopp and Keoner (1967) and measured by Perkin Elmer Atomic Absorption Spectrophotometer.

Determination of pesticides residues in water :

Residues of organophosphorus pesticides

Agilent 6890 gas chromatograph equipped with a flame photometric detector (FPD) with phosphorus filter . A fused silica capillary (PAS- 1701) , column containing 14 % cyanopropilsyloxane as stationary phase (30 m length * 0.32 mm internal diameter (i.d) * 0.25 um film thickness) , was used for the separation in the GC.

GC operating conditions were the following : Injector and detector temperatures were 240 C^0 and 250 C^0 , respectively ; initial oven temperature , 160 C^0 for 2 min , raised at 5 C^0/ min and then held at 240 C^0 for 2 min . The carrier gas was nitrogen at 3 ml / min . and hydrogen and air were used for the combustion at 75 and 100 ml / min. respectively. Recovery percentages were 90 % .

Residues of organochlorene pesticides

Hewlett Packard GC Model 6890 equipped with an Ni 63 electron capture detector . GC conditions : PAS – 5 methyl silicone (30 m * 0.32 mm i.d * 0.25 um film thickness) was used carrier gas : N2 at a flow rate of 4 ml / min. ; injector and detector temperatures were 300 and 320 C^0 , respectively . The initial column temperature was initial oven temperature , 160 C^0 for 2 min. raised at 5 C^0/ min. and then held at 280 $C^0$for 10 min .

The organochlorene residues components were identified by comparing their retention times with those of the standards quantified by extrapolation of corresponding sample peak areas with those from standared curves prepared for each pesticide standared . Small variations in retention times and response factors of each compound during the experiments were corrected for by obtained fresh chromatograms of the standard mixture after nine injections. Data were analyzed in pesticides residues laboratory in Giza , Egypt .

RESULTS AND DISCUSSION

1. Heavy metals in waste water .

Data presented in Table (1) shows the average concentrations (mg/L) of heavy metals in the waste water from EL – Kalubia drain were 0.61 , 4.79 , 0.72 , 0.44 , 0.12 , 0.05 , 0.15 , 0.02 and 3.00 mg/ L for Br , Fe , Zn , Mn , Cu , Co ,Ni , Cd and Pb from April 2015 to March 2016. Among the detected heavy metals in water, Mn and Cd concentrations exceeded the permissible limit by FAO (2003) .The waste water can polluted the soil or plants with Mn and Cd.

Data presented in Table (2) show that the average concentrations (mg/L) of heavy metals in the waste water from Belbais drain . Detected amounts were 0.52 , 4.38 , 0.70 , 0.38 , 0.13 , 0.04 , 0.11 , 0.02 and 3.52 mg/ L for B , Fe , Zn , Mn , Cu , Co ,Ni , Cd and Pb from April 2015 to Mar. 2016. Among the detected heavy metals in water, Mn and Cd concentrations exceeded the permissible limit by FAO (2003) .The waste water can polluted the soil or plants with Mn and Cd.

Table 1. Average concentrations (mg / L) of heavy metals in waste water from EL – Kalubia drain .

	Concentrations of heavy metals (Mg / L)								
Month	**Br**	**Fe**	**Zn**	**Mn**	**Cu**	**Co**	**Ni**	**Cd**	**Pb**
Apr.,2015	0.59	4.9	0.79	0.26	0.09	0.04	0.12	0.01	2.77
May.	0.58	3.9	0.72	0.24	0.10	0.10	0.11	0.02	3.23
Jun.	0.58	4.55	0.66	0.29	0.10	0.04	0.10	0.01	2.98
Jul.	0.59	5.78	0.78	0.34	0.11	0.12	0.21	0.04	4.25
Aug.	0.72	5.21	0.81	0.32	0.12	0.10	0.18	0.02	4.25
Sep.	0.63	4.99	0.73	0.31	0.11	0.04	0.18	0.02	3.75
Oct.	0.62	4.74	0.61	0.30	0.12	0.04	0.13	0.03	3.09
Nov.	0.56	4.76	0.62	0.29	0.14	0.03	0.08	0.03	2.93
Dec.	0.67	4.21	0.59	0.29	0.12	0.02	0.19	0.04	2.45
Jan.,2016	0.64	4.86	0.53	0.26	0.14	0.02	0.18	0.04	2.04
Feb.	0.63	4.90	0.98	0.25	0.10	0.04	0.19	0.01	2.14
Mar.	0.56	4.75	0.89	0.24	0.09	0.03	0.16	0.01	2.19
Mean	0.61	4.79	0.72	0.44	0.12	0.05	0.15	0.02	3.00
Maxium limit(mg/l).	0.75	5.00	2.00	0.20	0.20	0.05	2.50	0.01	5.00

Table 2. Average concentrations (mg / L) of heavy metals in waste water from Belbais drain .

	Concentrations of heavy metals (Mg / L)								
Month	**Br**	**Fe**	**Zn**	**Mn**	**Cu**	**Co**	**Ni**	**Cd**	**Pb**
Apr., 2015	0.44	4.70	0.66	0.36	0.13	0.05	0.09	0.01	3.70
May.	0.55	4.15	0.47	0.38	0.12	0.04	0.12	0.02	3.70
Jun.	0.55	4.05	0.59	0.37	0.14	0.05	0.14	0.01	2.67
Jul.	0.72	5.10	0.90	0.41	0.13	0.06	0.18	0.03	3.80
Aug.	0.56	4.95	1.02	0.38	0.13	0.05	0.12	0.01	3.65
Sep.	0.42	4.25	0.90	0.37	0.13	0.04	0.10	0.03	3.50
Oct.	0.38	4.31	0.45	0.38	0.15	0.05	0.06	0.03	3.50
Nov.	0.44	4.50	0.42	0.39	0.14	0.04	0.10	0.02	3.60
Dec.	0.44	3.77	0.39	0.38	0.14	0.04	0.11	0.02	3.70
Jan.,2016	0.60	4.00	0.57	0.41	0.14	0.04	0.14	0.02	3.80
Feb.	0.61	5.10	0.68	0.42	0.15	0.04	0.13	0.04	4.00
Mar.	0.59	4.35	0.78	0.40	0.13	0.04	0.13	0.02	3.80
Mean	0.52	4.38	0.70	0.38	0.13	0.04	0.11	0.02	3.52
Maxium limit(mg/l).	0.75	5.00	2.00	0.20	0.20	0.05	2.50	0.01	5.00

Data presented in Table (3) shows that the average concentrations of heavy metals in Baher EL – Baker drain were 0.46 ,3.45 , 0.54 , 0.19 , 0.12 , 0.08 , 0.13 , 0.05 and 2.86 mg / L for B , Fe , Mn , Cu , Co ,Ni , Cd and Pb ,respectively. Detected amounts of Zn , Pb and Ni were very low whereas Co and Cd average concentrations were higher than permissible limits FAO (2003).

In all waste water of the sites , the average concentration was maximum for Cd , Co and Mn exceeded the permissible limit .Zn and Ni concentrations were below the detectable limits in the waste water at the three sites . Waste water at Belbais , EL – Kalubia and Baher EL – Baker drains were more polluted in Cd and Mn , this can be justified by type of water . When heavy metals were accumulated in soil, they may be absorbed by soil components , such as clay minerals and iron and aluminium oxides and also form complexes with soil organic material . On the other hand , these metals can be leached into ground water (Abdel – Aal *et al*. 1989).

Table 3. Average concentrations (mg / L) of heavy metals in waste water from Baher EL – Baker drain .

	Concentrations of heavy metals (Mg / L)								
Month	**Br**	**Fe**	**Zn**	**Mn**	**Cu**	**Co**	**Ni**	**Cd**	**Pb**
Apr.,2015	0.37	2.80	0.38	0.17	0.11	0.02	0.12	0.05	2.50
May.	0.35	2.20	0.49	0.18	0.12	0.03	0.12	0.05	2.60
Jun.	0.41	2.70	0.54	0.20	0.12	0.02	0.14	0.05	2.60
Jul.	0.85	5.10	0.65	0.24	0.18	0.06	0.17	0.06	4.40
Aug.	0.58	4.15	0.60	0.21	0.13	0.04	0.15	0.06	3.50
Sep.	0.50	3.35	0.64	0.37	0.12	0.02	0.14	0.05	2.50
Oct.	0.57	3.30	0.63	0.19	0.12	0.02	0.14	0.05	3.15
Nov.	0.43	4.00	0.59	0.18	0.12	0.03	0.14	0.06	2.80
Dec.	0.44	3.35	0.56	0.17	0.13	0.03	0.14	0.06	2.56
Jan.,2016	0.38	3.20	0.49	0.14	0.11	0.03	0.13	0.05	2.55
Feb.	0.37	3.55	0.42	0.15	0.11	0.03	0.14	0.06	2.67
Mar.	0.35	3.75	0.49	0.13	0.11	0.02	0.14	0.05	2.52
Mean	0.46	3.45	0.54	0.19	0.12	0.08	0.13	0.05	2.86
Maxium limit(mg/l).	0.75	5.00	2.00	0.20	0.20	0.05	2.50	0.01	5.00

2. Pesticides in waste water .

The results in Table (4) show that the picture of pesticides in waste water of all drains were different . Sixteen organochlorene pesticides were tested to find the residues of them in all three drains. Data showed that the presence Endrin residues of pesticide Eldrin in EL Kalubia drains was 2.12 , while the residues of Endosulfan 11 in Belbais drain was 0.06 , respectively .

Also , Table (5) cleared that the amount of organophosphorus pesticides Trichlorofen residues in Baher EL – Baker and EL – Kalubia drains were 0.01 and 0.19mg/ L, respectively.

Pesticide waste water distinguishes itself because of its toxic and persistent nature in the environment. This waste water depicts a wide variation in its characteristics based on the pesticides manufacturing industry waste water .The WHO limits of the pesticide residues in water to 0.1 ug / L for an individual and to a total of 0.5 ug / L for all pesticides (WHO, 1984).

The total pesticides should be absent in drinking water and permissible limit up to 0.001 mg / L in surface water (pathak and Dikshit 2011 and Mauskar, 2007)

Table 4. Residues of organochlorene pesticides (ug/ mg)in waste water for Belbais , Baher EL- Baker and EL- Kalubia drains.

Components	Belbais drain	Baher El – Baker drain	El Kalubia drains
Alfa BHC	ND	ND	ND
Gama BHC	ND	ND	ND
Deta BHC	ND	ND	ND
Heptachlor	ND	ND	ND
Aldrin	ND	ND	ND
Heptachlor epoxide	ND	ND	ND
Endosulfan	ND	ND	ND
PP DDE	ND	ND	ND
Dieldrin	ND	ND	ND
Endrin	ND	ND	2.12
Endosulfan 11	0.06	ND	ND
PP DDD	ND	ND	ND
Endrin aldehyde	ND	ND	ND
Endosulfan sulfate	ND	ND	ND
PP DDT	ND	ND	ND
Methoxychlor	ND	ND	ND

ND : Non detectable

Table 5. Residues of organophosphorus pesticides (ug/mg) in waste water from Belbais , Baher EL- Baker and EL- Kalubia

Components	Belbais drain	Baher El – Baker drain	El Kalubia drains
Trichlorfen	ND	0.01	0.19
Ethoprophos	ND	ND	ND
Phorate	ND	ND	ND
Diazinion	ND	ND	ND
Dimethoate	ND	ND	ND
Pirimiphos – methyl	ND	ND	ND
Chlorpyriphos	ND	ND	ND
Malathion	ND	ND	ND
Quinelphos	ND	ND	ND
Profenofos	ND	ND	2.12
Fenamiphos	0.06	ND	ND
Ethion	ND	ND	ND
Triazophos	ND	ND	ND
Endosulfan sulfate	ND	ND	ND
PP DDT	ND	ND	ND
Methoxychlor	ND	ND	ND

ND : Non detectable

The standard residues of all pesticides in waste water were 0.1 mg / L . (Minstry of environment and forest 2011).

The overall impact of a pesticide depends on its behavior in the environment, its toxicity and amount applied , different pesticides pose different type of risks of the human and aquatic life . The persistent pesticides occur in the water cause potential adverse effects on the environment and public health . Due to high use of pesticides in the agricultural developed area country. The problem of water pollution has become still worse due to toxic organic components , organic pollutants include pesticides , fertilizers , hydrocarbons , phenols and carbohydrates. The main source of pesticides is the pesticides production plants and agricultural area (Bhausaheb *et al.* 2014). The current study recommends that treatment waste water from pesticides residues and heavy metals for reuse again in irrigation at Agriculture.

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تقييم الملوثات فى مياه الصرف الزراعي فى بعض المصارف بجمهوريه مصر العربيه

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قسم وقايه النبات – كليه الزراعه – جامعه الزقازيق

اجريت هذه الدراسة لتقدير تركيزات كل من المعادن الثقيلة والمبيدات فى مياه الصرف فى ثلاثة مصارف رئيسيه فى مصر . هذه المصارف هى مصرف بلبيس ومصرف القليوبيه ومصرف بحر البقر . تم اخذ العينات من نهاية كل مصرف على حده . وتم تجميع العينات شهريا لمده ١٢ شهر بداية من ابريل ٢٠١٥ حتي مارس ٢٠١٦ لتقدير المعادن الثقيلة ومن شهر فبراير ٢٠١٦ لتقدير متبقيات المبيدات . تم تقدير عناصر الكوبلت والحديد و الكرومنيوم و المنجنيز والبروم والرصاص والكاديوم والنيكل والزنك بجهاز الامتصاص الذري. اوضحت النتائج ان بعض تركيزات المعادن الثقيله تعدت الحدود المسموح بها فى مياه العينات . كان متوسط تركيزات كل من الزنك والمنجيز والكاديوم ٠.٧٢ ، ٠.٤٤ ، ٠.٠٢ ملليجرام / لتر فى مصرف القليوبيه ٠.٧ , ٠.٣٨ ، ٠.٠٢ فى مصرف بلبيس بينما كانت فى مصرف بحر البقر ٠.٥٤ ، ٠.٠٥ لكل من الزنك والكاديوم علي الترتيب . ولقد اختلفت الصوره بالنسبه لمتبقيات المبيدات حيث اوضحت النتائج ان تركيزات مبيد اندوسلفان ١١ كانت ٠.٠٦ ملليجرام / جرام فى مصرف بلبيس ومبيد اندرين ٢.١٢ فى مصرف القليوبيه ومبيد الترايكلورفان كانت ٠.٠١ ، ٠.١٩ ملليجرام / جرام فى كل من مصرف القليوبيه وبحر البقر على الترتيب .