

## **STUDY ON SOME AGROCHEMICAL POLLUTANTS IN DRAINS WATER AT NORTH DELTA, EGYPT**

**Antar, A. S. ; A. A. S. Gendy and G. M. A. El-Sanat**

**Soils, Water and Environment Res. Inst., Agric. Res. Center Egypt.**

### **ABSTRACT**

Drains in North Delta, Egypt (Kafr El-Shiekh Governorate) were used for receiving waste water (drainage water of the fields, sanitary and industrial). Because of the shortage of irrigation water, such water, is used in irrigation of agricultural crops, therefore, it becomes a dangerous source of pollution as it contains different contaminants of agrochemical pollutants. The aim of the present study was to monitor the presence of some serious agrochemical pollutants (some pesticides, heavy metals and nitrate) in waste water of the main drains in North Delta, Egypt in order to assess the degree of pollution in the water of these drains for agricultural purposes.

Data revealed that salinity and sodicity values of the studied drainage water samples ranged between 1.45 to 3.05 dS/m and 5.95 to 10.18%, respectively. According to USDA diagram, the studied samples are in class  $C_3S_1$  and  $C_4S_2$ .

Malathion concentration in drains water was ranged between 0.13 to 1.15  $\mu\text{g L}^{-1}$  and was not depending on sampling time (winter and summer). Atrazine concentration in drains water was ranged from 0.04 to 0.19  $\mu\text{g L}^{-1}$  and was higher in summer than in winter.

Heavy metals concentrations in drainage water were higher in summer than in winter. The concentrations of Cu, Mn, Zn, Cd, Ni and pb in winter for all drains were varied from 0.23 to 0.51, 0.20 to 0.28, 0.17 to 0.38, 0.01 to 0.09, 0.24 to 0.79 and 0.08 to 0.25  $\text{mg L}^{-1}$ , respectively. The corresponding concentrations in summer were 0.29 to 0.67, 0.22 to 0.36, 0.23 to 0.46, 0.05 to 0.15, 0.35 to 1.21 and 0.19 to 0.46  $\text{mg L}^{-1}$ , respectively. The highest concentration levels were for Cu, Mn, Ni and Cd in all drains comparing to maximum permissible levels stated by FAO, 1992, (0.2, 0.2, 0.2, and 0.01  $\text{mg L}^{-1}$ ), respectively. While, pb and Zn levels were lowest than the maximum permissible levels stated by FAO (1992), (pb, 5  $\text{mg L}^{-1}$  and Zn, 2  $\text{mg L}^{-1}$ ).

Concentrations of  $\text{NO}_3^-$  were 18.5 to 112  $\text{mg L}^{-1}$  in all drains for winter and summer. Nitrate nitrogen concentrations leaving surface drains in North Delta, Egypt exceed the U. S. Environmental Protection Agency (1991) maximum contaminant level for drinking water of 10  $\text{mg L}^{-1}$ .

Results of the present study, reveals that the water of these drains are highly dangerous on the environment and human health, when used as it is without good treatment. So these waters must be remediated from such contaminants.

**Keywords.** Pesticides, heavy metals, nitrate, drainage water, pollution, Delta.

### **INTRODUCTION**

Pollution defines as any substance introduced into the environment that adversely affects usefulness of a resource. Nearby surface water is more susceptible to contaminations when agrochemicals (pesticides, nitrate and heavy metals) are applied to highly erodible soils or to over-irrigated or rain-soaked fields. Using the wrong pesticide or an incorrect application method in these situations increases the risk for contamination. The increasing dependence on pesticides application noticed nowadays confirms one of the major sources of pollution to our community. It is a very serious problem as

most of these chemicals might contain toxic heavy metals or organic groups that are hazard to the metabolism of living organisms leading to very serious diseases to mankind (Gimeno-Garica *et al.*, 1996 and Abd El-Razik, 2006). In recent years, using of pesticides has been restricted in many countries because of suspicion that these compounds are the major source for the environments and their transformation products are sometimes finding in animal and human tissues, animal and human milk, drinking water and soil (Asplund *et al.*, 1994). Therefore, essential knowledge about pesticides residues and their transformation products in surface water is one of the most important factors for the environmental problem in Egypt.

Toxic metal pollution of waters and soils was a major environmental problem. The mean problem concerned with water pollution was heavy metals when water containing these metals, as a pollutants, used for irrigation, it will contaminate and enrich soils and crops (Mireles *et al.*, 2004). It was known that heavy metals could accumulate in tissues during aquatic organism growth (bioaccumulation) and often biomagnified up the food chain interfering with the health and reproduction of both wildlife and humans (Abd El-Razik, 2006). Generally, metals such as cadmium, copper, molybdenum, nickel and zinc (all except molybdenum are also known as heavy metals) could cause serious health risks to human beings and animals. Rarely, these metals exhibit toxicity to plants, but in most cases they are accumulated in the plants *per se* and when the latter are consumed by humans or by domestic animals, the health hazard develops (FAO/RNEA, 1993). El-Sanafawy *et al.* (2010) found that concentrations of heavy metals (pb, Cd, Ni, Zn, Cu and Mn) in wastewater drains of Middle Delta region were higher than the maximum permissible levels by FAO (1992) except for Zn which was found within the permissible concentration.

A water quality issue of particular concern has been the export of nutrients, and sediment to the lakes and streams. Some of the highest losses of nitrate to surface waters come from drained agricultural land (Bjorneberg *et al.*, 1998 and Ramadan *et al.*, 2009). Intensely farmed landscapes export excess nutrients and sediments to streams, which leads to downstream turbidity and eutrophication problems, as well as potential community shifts to toxic species of algae, reduced fish and crustacean populations, human health risks, and aesthetic problems (Nolan and Stoner, 2000). In addition, since some municipalities use surface waters for human consumption, the  $\text{NO}_3^-$  concentration in these waters must be  $<10\text{mg N/L}$ . Nitrate can be readily converted to  $\text{NO}_2^-$  in the human body, and has been implicated in two major health problems: Blue-baby syndrome (methaemoglobinaemi) and stomach cancer (Drury *et al.*, 1993). Abd El-Ghani *et al.* (1994) reported that high amounts of  $\text{NO}_3^-$ -N were detected in drainage water. Being  $59\text{ mgL}^{-1}$  and  $152\text{ mgL}^{-1}$  in surface and tile drainage systems, respectively.

Pollution by pesticides, nitrate and heavy metals chemical can cause serious problems in the framework of aquatic environment, which lead to adverse effects of the water quality and its biota. Trace analysis of chemical pollutions, especially pesticides, nitrate and heavy metals in surface water presents one of the most important factors to solve the problems of the environmental pollution.

Therefore, the aim of the present study is to determine some agrochemical pollutions (some pesticides, nitrate and heavy metals) in drainage water through winter and summer and also, evaluate the quality of surface water in the area of study.

## **MATERIALS AND METHODS**

### **Area of study and collection of surface water samples for analyses:**

**Al-Gharbiyyah Ar-Raisi drain:** This canal is one of many drainage canals present in the area of study, it receives drainage water from adjacent fields (i.e.) (drainage system of the irrigation water, industrial and sanitary). Where its length is about 56.5 km, it serves about 240500 Faddens.

**Drain No.7:** This canal is one of many drainage canals present in the area of study, it receives drainage water from adjacent fields (i.e.) (drainage system of the irrigation water). Where its length is about 42.52 km, it serves about 64282 Faddens.

**Drain No.8:** This canal is one of many drainage canals present in the area of study, it receives drainage water from adjacent fields (i.e.) (drainage system of the irrigation water). Where its length is about 23 km, it serves about 68000 Faddens.

**Drain No.9:** This canal is one of many drainage canals present in the area of study, it receives drainage water from adjacent fields (i.e.) (drainage system of the irrigation water). Where its length is about 19.800 km, it serves about 45225 Faddens.

**Drain No.10:** This canal is one of many drainage canals present in the area of study, it receives drainage water from adjacent fields (i.e.) (drainage system of the irrigation water). Where its length is about 21.550 km, it serves about 17000 Faddens.

**Drain No.11:** This canal is one of many drainage canals present in the area of study, it receives drainage water from adjacent fields (i.e.) (drainage system of the irrigation water). Where its length is about 18.860 km, it serves about 57000 Faddens.

Water samples were collected from the cites illustrated before (Fig 1). The locations cites are situated between 31°28' 53" and 31°01' 22" N latitude and 30°33' 35" and 31°13' 07" E longitude. Water samples were collected during winter (January, 2011) and summer (July, 2011). The collected water samples transferred immediately to the laboratory for extraction and analyses of pesticides, heavy metals and nitrate pollutants.

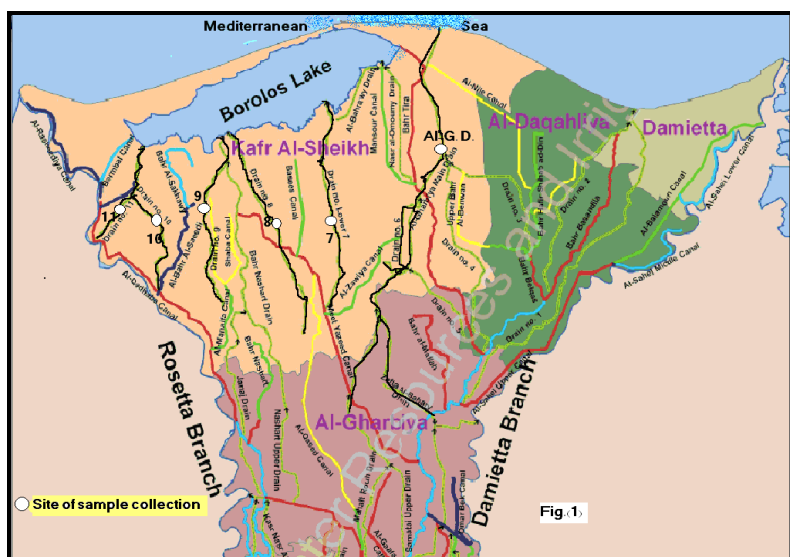


Fig (1): Sites of sample collection.

#### Pesticides analysis:

- 1- In 1 L. separator funnel, 500 ml water sample and 50 ml of 15% dichloromethane in hexane were shaken for 2 min.
- 2- The AQ. layer was taken in another 1 L separator funnel and shaken with 50 ml of 15% dichloromethane in hexane were shaken for 2 min.
- 3- The AQ. layer was discarded and the solvent of steps (1) and (2) was collected and passed on column of anhyd.  $\text{Na}_2\text{SO}_4$ . The column was washed with 10 ml hexane (3 times) and the volume (V) was recorded. The solvent was evaporated to 5 ml. 5-10  $\mu\text{l}$  of evaporated solvent was injected into a gas chromatography. Equipped with electron capture detector in case of atrazine, but in case of malathion flame photometric was used according to U.S. Department of Health and Human Services, 1994.

#### Heavy metals analysis:

Soluble heavy metals (Cu, Mn, Zn, Cd, Ni and Pb) were determined using the standard method described by American Public Health Association (APHA, 1971). The collected water samples were filtered and evacuated under vacuum in a water path until analysis. The residues were soaked with 10ml of Aquai regia then digested and analyzed using Atomic Adsorption Spectrophotometer Perkin Elmer 3300.

#### Nitrate analysis:

Nitrate and ammoniacal nitrogen in water samples were analyzed using Kjeldahl method (Cottenie *et al.*, 1982).

## RESULTS AND DISCUSSION

#### Water salinity and sodicity:

The salinity and sodicity of the drainage water might be affected by some factors such as land use, crop pattern, soil management, drains

location and drainage efficiency. Data in Table (1) revealed that salinity and sodicity values of the studied drainage water samples ranged from 1.45 to 3.05 dS/m and 5.95 to 10.18%, respectively through out the two periods (winter and summer). The monitored concentrations of salinity and sodicity in the studied drains water were mostly considered slight to moderate according to international guideline concentrations mentioned by FAO/RNEA (1993) which are  $EC_w$ , 0.7 - 3 dS/m and SAR, 3 - 9 %. The increase in salinity and sodicity in the drainage water of this studied area are mainly ascribed to the inflow and contamination with the saline water, through the sea water intrusion. Data in the same table revealed that, salinity and sodicity concentrations in drainage water were higher in winter than in summer. These decrements of salinity and sodicity in summer are due to the high amounts of irrigation water with rice fields which led to dilution of drainage waters.

According to USDA diagram, the studied samples of Al-Gharbiyyah Ar-Raisi drain, drain No 10 and drain No 11 are in class  $C_3S_1$  while, drain No 7, drain No 8 and drain No 9 are in class  $C_4S_2$ . According to U.S. Salinity Laboratory (1954) classification  $C_3S_1$  Class water is high saline and low sodium content. Such water can be used with restricted drainage even with adequate drainage, special management for salinity control may be required, and salt tolerant plants must be selected. Therefore, such water is considered slightly dangerous for irrigation purposes.  $C_4S_2$  indicate that the water are very high saline with medium sodium content. These water are not suitable for irrigation for soils under ordinary conditions but may be used occasionally under very special circumstances. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess, to provide considerable leaching and highly salt tolerant crops should be selected. Sodium was present in appreciable sodium hazard in fine textured soils having high cation exchange capacity, specially under low leaching conditions, unless gypsum present in the soil. Such water may be used on coarse textured or organic soil with good permeability.

**Table1: EC (dS/m) and SAR of water samples collected from studied drains.**

Site	Winter		Summer	
	EC (dS/m)	SAR	EC (dS/m)	SAR
Al-Gharbiyyah Ar-Raisi drain	1.96	7.53	1.84	7.05
Drain No 7	2.63	10.18	2.28	8.96
Drain No 8	3.05	10.06	2.57	9.60
drain No 9	2.26	9.03	2.25	8.91
Drain No 10	1.45	6.45	1.45	6.08
Drain No 11	1.81	6.54	1.58	5.95

### Pesticides

Malathion (diethyl [(dimethoxy phosphinothioyl) thio] butanedioate) is used extensively insecticide in Egypt to store grains. Also, malathion used to control of *Apamea sordida* Hufn and *Haplodiplosis marginata*, which caused serious damages to wheat and other small-grain cereals. Whereas, malathion

caused a good control of larvas under 20cm soil (Ning-Huan Geng *et al.*, 1995). Pesticides transport occurs mainly in the aqueous phase, because many pesticides have water solubilities greater than 10 mgL<sup>-1</sup> and are marketed as water-soluble formulations. The solubility of malathion in water is 145 mgL<sup>-1</sup> (The Pesticide Manual,2002). The concentration levels of malathion in drains water of North Delta, Egypt were ranged from 0.13 µgL<sup>-1</sup> to 1.15 µgL<sup>-1</sup> in both winter and summer (Table, 2). Kammerbauer and Moncada (1998) found that organophosphorus compounds are found mostly in water and less frequently in soils. Also, diazinon, dimethoate, malathion and trebufos were found mostly in the aqueous environments, but at relatively low frequencies (<5%). Also, no obvious trained for malathion concentrations with sampling time (winter and summer).

Atrazine (2-chloro-4-ethylamino-6-isopropylamino-s-atrazine) is a commonly used herbicide in corn growing areas of Egypt. Because of its heavy usage, moderate persistence, and mobility in soils (Walker,1987 and Erickson and Lee,1989). Atrazine concentration in drains water of North Delta, Egypt were ranged from 0.04 µgL<sup>-1</sup> to 0.19 µgL<sup>-1</sup> in both winter and summer (Table, 2). The maximum allowed contaminant level of 3 µg<sup>-1</sup> (U.S. Environmental Protection Agency,1991) for atrazine in drinking water was not obtained in drainage water., Atrazine concentration in the studied water sample was higher in summer than in winter. The high levels of atrazine in summer might be due to the water current speedily in summer faster than in winter and the rate of evaporation was relatively high. It may be also due to addition of this pesticide in the summer on corn crop.

Variation in residual levels of the studied samples could be due to locations and timing of the sampling. The results of the current survey showed that the drainage waters in the studied area have particular problems with respect to pesticide residues. So, these waters must be remediated from these contaminants.

**Table 2: Pesticides concentrations of water samples collected from studied drains.**

Site	Pesticides (µgL <sup>-1</sup> )			
	Malathion		Atrazine	
	Winter	Summer	Winter	Summer
Al-Gharbiyyah Ar-Raisi drain	1.15	0.74	0.08	0.14
Drain No 7	0.71	0.54	0.08	0.11
Drain No 8	0.78	0.87	0.06	0.04
drain No 9	0.13	0.15	0.04	0.09
Drain No 10	0.63	0.74	0.07	0.08
Drain No 11	0.56	0.51	0.11	0.19

### Heavy metals

Heavy metals concentrations (Cu, Mn, Zn, Cd, Ni and Pb) in drains water of North Delta varied from one metal to another, and also from one drain to another. With regard to Table (3) showed that heavy metals concentrations in drainage water were higher in summer than in winter. The concentrations of Cu, Mn, Zn, Cd, Ni and pb in winter for all drains were varied from 0.23 to 0.51, 0.20 to 0.28, 0.17 to 0.38, 0.01 to 0.09, 0.24 to 0.79

and 0.08 to 0.25 mgL<sup>-1</sup>, respectively. The corresponding concentrations in summer were 0.29 to 0.67, 0.22 to 0.36, 0.23 to 0.46, 0.05 to 0.15, 0.35 to 1.21 and 0.19 to 0.46 mgL<sup>-1</sup>, respectively. The high levels of heavy metals in drainage waters in summer might be due to the water current speedily in summer faster than in winter and the rate of evaporation was relatively high. Results obtained were agreed with findings of Abd El-Razik, 2006). Heavy metals concentrations (Table,3) in Al-Gharbiyyah Ar-Raisi drain were higher than other drains in both seasons. This might be due to the pollution with the industry wastes or by the factories which produced oil, soap or textile and dyes in El-Gharbia and KafrEl-Sheikh Governorates. The highest concentration levels were for Cu, Mn, Ni and Cd in all drains comparing to maximum permissible levels stated by FAO, 1992, (0.2, 0.2, 0.2, and 0.01 mgL<sup>-1</sup>), (Table,3), respectively. While, pb and Zn concentrations ranged from 0.08 to 0.46 mgL<sup>-1</sup> and 0.17 to 0.46 mgL<sup>-1</sup>, respectively, it were lowest than the maximum permissible levels stated by FAO, 1992, (pb, 5 mgL<sup>-1</sup> and Zn, 2 mgL<sup>-1</sup>). Drainage waters were generally highly contaminated by heavy metals in both winter and summer at all sampling sites. Therefore, the use of these wastewater without good treatment make these toxic elements accumulated in soil with time, leading to increase of their concentrations in soils and plants and therefore, inter into the food chain causing dangerous complications to man and other biota. These toxic metals may cause kidney and liver failure, anemia, cancer, in addition to chromosomal aberrations (El-Sanafawy *et al.* 2010).

**Table 3: Heavy metals concentrations of water samples collected from studied drains.**

Heavy metals (mgL <sup>-1</sup> )	Season	Site					
		Al-Gharbiyyah Ar-Raisi drain	Drain No 7	Drain No 8	drain No 9	Drain No 10	Drain No 11
Cu	Winter	0.51	0.27	0.29	0.27	0.25	0.23
	Summer	0.67	0.38	0.34	0.36	0.33	0.29
Mn	Winter	0.28	0.23	0.22	0.20	0.25	0.24
	Summer	0.36	0.28	0.22	0.26	0.29	0.27
Zn	Winter	0.38	0.27	0.18	0.17	0.22	0.32
	Summer	0.46	0.33	0.23	0.25	0.31	0.31
Cd	Winter	0.09	0.01	0.02	0.05	0.04	0.07
	Summer	0.15	0.05	0.05	0.11	0.07	0.10
Ni	Winter	0.79	0.59	0.31	0.5	0.32	0.24
	Summer	1.21	0.81	0.69	0.4	0.58	0.35
Pb	Winter	0.25	0.09	0.19	0.13	0.08	0.12
	Summer	0.46	0.27	0.23	0.19	0.28	0.26

#### **Nitrate and ammonia**

Nitrogen in drainage waters are mainly in the form of nitrate, but may also in the form of ammonium because although ammonium readily adsorbed by the colloids is rapidly oxidized into nitrates. Concentration of NH<sub>4</sub><sup>+</sup>-N in drain waters of studied area (Table 4) was less than the NO<sub>3</sub><sup>-</sup>-N. Duxbury and Peverly (1978); Antar (2005) and Ramadan *et al.* (2009) reported that the concentration of NH<sub>4</sub><sup>+</sup>-N in drainage water was less than the NO<sub>3</sub><sup>-</sup>-N.

The horizontal subsurface drainage system, in addition to controlling water table and leaching out harmful dissolved salt from the drained soil profile, may also cause losses of various forms of nitrogen through the drainage effluent. Such nitrogen losses, besides may leach and pollute both ground water and surface water, are also likely to cause environmental degradation that will be detrimental to aquatic life, plants, animals and human (Singh, 2002). Nitrate and ammonia concentrations of water samples collected from studied drains (Table,4) varied in a relatively wide range. Whereas, the concentrations of  $\text{NO}_3^-$  and  $\text{NH}_4^+$  were from 18.5 to 112 and 3.1 to 12.8  $\text{mgL}^{-1}$ , respectively in all drains for winter and summer. Nitrate nitrogen concentrations leaving surface drains in North Delta, Egypt exceed the U. S. Environmental Protection Agency (1991) maximum contaminant level for drinking water of 10  $\text{mg L}^{-1}$ . The considerable variation in  $\text{NO}_3^-$  concentration in drainage water may be ascribed to several factors including soil properties, amount of irrigation water, temperature of the air and evaporation rates, drainage system and forms of applied fertilizers, uptake by plants and adsorption and fixation of  $\text{NH}_4^+$  on the 2: 1 type clay minerals (Dinnes *et al.*, 2002). Nitrate and ammonia ( $\text{mgL}^{-1}$ ) concentrations (Table,4) in Al-Gharbiyyah Ar-Raisi drain were higher than other drains in both seasons. The concentrations of  $\text{NO}_3^-$  in Al-Gharbiyyah Ar-Raisi drain were 98 and 112  $\text{mgL}^{-1}$  for winter and summer, respectively. The corresponding concentrations of  $\text{NH}_4^+$  11.4 and 12.8  $\text{mgL}^{-1}$ , respectively. This might be due to the pollution with the drainage water of the fields, industrial and sanitary in El-Gharbia and KafrEl-Sheikh Governorates. With concerning to sampling time (winter and summer), no obvious trend for nitrate and ammonia concentrations (Table,4).

**Table 4: Nitrate and ammonia concentrations of water samples collected from studied drains.**

Site	Nitrate and ammonia ( $\text{mgL}^{-1}$ )			
	$\text{NO}_3^-$		$\text{NH}_4^+$	
	Winter	Summer	Winter	Summer
Al-Gharbiyyah Ar-Raisi drain	98	112	11.4	12.8
Drain No 7	66	75	9.5	8.5
Drain No 8	63	63	9.6	9.3
drain No 9	49	18.5	8.7	7.5
Drain No 10	66	58	4.4	3.1
Drain No 11	48	61	5.9	6.5

It is of interest to remember that these wastewaters resources ,of the present investigation, has already been used for irrigation due to the decrease of clean water especially in regions of the North Delta which were located at the end of irrigation and drainage canals, and there was a scarcity in clean water for irrigation. Water contaminated by effluents from various sources is associated with heavy disease burden (Okoh *et al.*, 2007) and this could influence the current shorter life expectancy in the developing countries compared with developed nations (WHO, 2002). In developing countries, most of which have huge debt burdens, population explosion and moderate to rapid urbanization, people rely heavily on water sources of doubtful quality



in the absence of better alternatives, or due to economic and technological constraints to adequately treat the available water before use (Calamari and Naeve, 1994; Aina and Adedipe, 1996). The scarcity of clean water and pollution of fresh water has therefore led to a situation in which one-fifth of the urban dwellers in developing countries and three quarters of their rural dwelling population do not have access to reasonably safe water supplies (Lloyd and Helmer, 1992).

## **REFERENCES**

- Abd El-Ghani, M. B.; M. S. Abdel Dayem; A.A. El-Sayed and M .M. El-Fouly (1994). Importance of protecting the environment and water resources from pollution with fertilizers. *Water Sci.*, 14<sup>th</sup> Issue. October. 1194, p. 91-103.
- Abd El-Razik M. A. S. (2006). Toxicological studied on some agrochemical pollutants. M.Sc. Thesis. Fac. of Agric. Kafrelsheikh university, Egypt.
- Aina, E.O.A.; N.O. Adedipe (1996). Water quality monitoring and environmental status in Nigeria. FEPA Monograph 6, FEPA, Abuja, Nigeria, 239.
- American Public Health Association (APHA) ( 1971). Standard methods for examination of water and wastewater. 1st ed., Washington, p. 874.
- Antar, S. A. (2005). Movement of some nitrogen forms, atrazine and malathion in clay soil as affected by drain spacings. Ph.D.Thesis. Fac. Of Agric. Tanta University, Egypt.
- Asplund, L.; B. G. Svensson; A. Nilsson; U. Eriksson; B. Jansson; S. Jensen; U. Wideqvist and S. Skerfving (1994). Poly-chlorinated biphenyls p,p-DDT and p,p-DDE in human plasma related to fish consumption. *Archives of Environmental Health*. 49 (6): 477-486.
- Bjorneberg, D. L.; D. L .Karlen; R. S. Kanwar; and C. A. Cambardella (1998). Alternative N fertilizer management strategies effects on subsurface drain effluent and N uptake. *Applied Eng. In Agric*. 14 (5):469-473.
- Calamari, D. and H. Naeve (1994). Review of pollution in the African aquatic environment. Committee for Inland Fisheries of Africa (CIFA) Technical paper No. 25, FAO, Rome, 118.
- Cottenie, A.; M. ver Loo; L. Mjkiekens; G. Velghe and R. Comertynck (1982). Chemical analysis of plant and soil. *Lab. Anal. And Agrochem*. State Univ., Gent., Belgium, Chapter 2 and 3, pp. 14-54.
- Dinnes, D. L.; D. L. Karten; D. B. Jaynes; T. C. Kaspr; J. L. Hatfield; T. S. Colvin and C. A. Cambardella (2002). Nitrogen management strategies to reduce nitrate leaching in tile drained Midwestern soils. *Agronomy J*. 94 (1): 153- 171.
- Drury C. F.; D. J. McKenney; W. I. Findlay and J. D. Gaynor (1993). Influence of tillage on nitrate loss in surface runoff and tile drainage. *Soil Sci. Soc. Am. J*. 57: 797-802.
- Duxbury,J.M. and J.H. Peverly (1978). Nitrogen and phosphorus losses from organic soils. *J. Environ. Qual.*, 7: 566-570.

- El-Sanafawy Hameda M.A.; Nour El-Din, M. and N. I. Talha (2010). Monitoring of some chemical and biological pollutants in wastewater drains of Middle Delta region. Egyptian Soil Science Society (ESSS) 9<sup>th</sup> National Conference on Oct. 18-20, 2010, Cairo, P3-3.
- Erickson, L. E. and K. H. Lee (1989). Degradation of atrazine and related s-triazines. Crit. Rev. Environ. Control.,19: 1-14.
- FAO (1992). Wastewater treatment and use in agriculture - FAO irrigation and drainage paper 47, FAO, Rome. (1992).
- FAO/RNEA, (1993). Considerations of wastewater reuse system for irrigation. Tech. Bull. No. 7, P. 18.
- Gimeno-Garica, E.; V. Andrev and R. Boluda (1996). Heavy metals incidence in the application of inorganic fertilizers and pesticides to rice farming soils. Environ. Pollution, 92: 19-25.
- Kammerbauer, J. and J. Moncada (1998). Pesticide residue assessment in three selected agricultural production systems in the Choluteca River Basin of Honduras. Environ. Pollut. 103: 171-181.
- Lloyd, B. and R. Helmer (1992). Surveillance of drinking water quality in rural area. Longman Scientific and Technical Publication. New York, Wiley. 34-56.
- Mireles, A.; C. Solis; E. Andrade; M. Lagunas-Solar; C. Pina and R. G. Flocchini (2004). Heavy metal accumulation in plants and soil irrigated with wastewater from Mexico City. Nuclear instruments and Methods in physics Research B. In press. www. Elsevier. Com. From Science Direct. Com.
- Ning-H. G.; Shi-Z.L and L. Bai (1995). A study on the occurrence and control of *Apamea sordida* Hufn in Shanxi. Plant-Protection. No. 1, 14-15.
- Nolan, B.T., and J.D. Stoner. (2000). Nutrients in groundwaters of the conterminous United States 1992-1995. Environmental Science and Technology. 34: 1156-1165.
- Okoh, A. I.; Odjadjare, E. E.; Igbinosa, E. O. and A. N. Osode (2007). Wastewater treatment plants as a source of microbial pathogens in the receiving watershed. Afr. J. Biotech. 6 (25), 2932-2944 (13 pages).
- Ramadan, S. A.; A. S. Antar; A. A. El-Leithi and I. E. Nasr El-Din (2009). Impact of different nitrogen forms and K added on N and K losses into drainage water under cotton cultivation in clay soil of north delta. J. Agric. Res. Kafer El-Sheikh Univ., 35 (2), 776 – 790.
- Singh, M., A. K. Bhattacharyaa, T. V. R. Nairb, and A. K. Singh. (2002). Nitrogen loss through subsurface drainage effluent in coastal rice field from India. 52(3): 249-260.
- The Pesticide Manual Version 2.2., (2002). The British Crop Protection Council.
- U. S. Department of Health and Human Services (1994). Pesticide Analytical Manual Vol. 1: Multiresidue Methods. 3<sup>rd</sup> Edition. Public Health Service. Food and Drug Administration (FDA).
- U. S. Environmental Protection Agency (1991). National primary drinking water regulations, final rule. Fed. Regist. 56(20): 3526-3594.
- U.S. Salinity Laboratory Staff (1954). Diagnosis and Improvement of Saline and Alkali Soil. U.S. Dep., Agric., Handbook, No. 60.

Walker, A. (1987) . Herbicide persistence in soil. Rev. Weed Sci. 3: 1-17.  
WHO, (2002). Water and health in Europe: A joint report from the European Environment Agency and the WHO Regional Office for Europe World Health Organization, WHO Regional Publications, European Series No. 93.

### **دراسة بعض الملوثات الكيماوية الزراعية في مياه المصارف بشمال دلتا مصر عنتر شعبان عنتر والجندي عبد الرازق سليمان جندي وجمال محمد عبد السلام الصناط مركز البحوث الزراعية- معهد بحوث الأراضي والمياه والبيئة- الجيزة - مصر**

المصارف في شمال دلتا مصر (محافظة كفر الشيخ) تستقبل مياه الصرف الصحي والصناعي والزراعي مما يجعلها شديدة التلوث أحيانا، هذه المياه العادمة تتعرض لمعالجة أولية فقط ، و نظرا لقلة مياه الري بهذه المنطقة غالبا ما تستخدم هذه المياه في ري المزروعات المختلفة بما تحويه من بعض الملوثات الكيماوية الزراعية. وتهدف هذه الدراسة لرصد هذه الملوثات الكيماوية الزراعية (بعض المبيدات والعناصر الثقيلة والنترات) الموجودة في تلك المصارف للوقوف على درجة تلوث هذه المياه العادمة مقارنة بالمعايير الدولية لتحديد مدى صلاحية التعامل البشري مع هذه المياه لاستخدامها في الأغراض الزراعية. وتوضح النتائج أن قيم الملوحة في عينات مياه الصرف المدروسة تتراوح من 1.45 إلى 3.05 ديسيمنز /المتر والصودية من 5.95 إلى 10.18 % وهي تقع في القسمين (C3 -S1 ; C4 -S2) تبعا لتقسيم معمل الملوحة الأمريكي لصلاحية مياه الري. وبالنسبة للمبيدات وجد أن تركيز مبيد الملاثيون في مياه المصارف المدروسة يتراوح من 0.13 إلى 1.15 ميكروجرام في اللتر، ولم يوجد تأثير واضح على تركيز الملاثيون بين فترتي الشتاء والصيف، وأيضا تراوح تركيز مبيد الأترازين من 0.04 إلى 0.19 ميكروجرام في اللتر، وأيضا لوحظ زيادة في تركيز الأترازين في فترة الصيف عن الشتاء. وهذه التركيزات أقل من الحدود الحرجة لهذه المبيدات. وتوضح النتائج زيادة تركيزات العناصر الثقيلة في الصيف عن الشتاء حيث تراوحت تركيزات النحاس، المنجنيز، الزنك، الكاديوم، النيكل، الرصاص على التوالي 0.23 إلى 0.51 ، 0.20 إلى 0.28 ، 0.17 إلى 0.38 ، 0.01 إلى 0.09 ، 0.24 إلى 0.79 ، 0.08 إلى 0.25 جزء في المليون في فترة الشتاء، وكانت التركيزات المماثلة لنفس العناصر على التوالي في فترة الصيف هي 0.29 إلى 0.67 ، 0.22 إلى 0.36 ، 0.23 إلى 0.46 ، 0.05 إلى 0.15 ، 0.35 إلى 1.21 ، 19 إلى 0.46 جزء في المليون. وهذه التركيزات للعناصر الثقيلة قيد الدراسة بمياه الصرف أعلى من أقصى معدل مسموح به تبعا لمنظمة الأغذية والزراعة (FAO) ماعدا عنصري الزنك والرصاص أقل من الحد المسموح بها. والنتائج توضح زيادة كبيرة في تركيز النترات في مياه المصارف المدروسة تفوق بكثير الحد المسموح به (10 جزء في المليون) تبعا للوكالة الدولية لحماية البيئة حيث تراوح تركيز النترات من 18.5 إلى 112 جزء في المليون. من خلال نتائج هذه الدراسة يمكن الإشارة إلى أن هذه المياه ملوثة وهي شديدة الخطورة على الإنسان والبيئة عند استعمالها بهذه الصورة ، ويجب معالجتها معالجة جيدة من تلك الملوثات قبل استعمالها.

**قام بتحكيم البحث**

**كلية الزراعة – جامعة المنصورة  
كلية الزراعة – جامعة كفر الشيخ**

**أ.د / احمد عبد القادر طه  
أ.د / صابر عبده جاهين**