J. Agric. Res. Tanta Univ., 32 (3) 2006

MONITORING AND REMOVAL OF PESTICIDE RESIDUES IN DRINKING WATER COLLECTED FROM KAFR EL-SHEIKH GOVERNORATE, EGYPT.

Ashry, M. A.; O.C. Bayoumi, I.-I. El-Fakharany, A. S. Derbalah and A. A. Ismail
Pesticides Department, Fac. Of Agric. Kafr El-Sheikh Univ., Egypt.

ABSTRACT

Drinking water contamination by agrochemicals particularly pesticides is an important environmental and health issue in different part of the world. Monitoring of pesticide residues was conducted at different sources of water purification plants in Kafr El-Sheikh governorate (Kafr El-Sheikh, Fowa, El-Hamoul, Mehalet Abuali and Ebshan). Furthermore, the removal of pesticide residues in drinking water by using powdered activated carbon was evaluated at both the intake and outlet of each water purification plant. The results showed that, aldrin, lindane, DDE, DDD, dimethoate, methyl parathion and malathion were the detected pesticides. Organochlorin pesticides (OCPs) detected with higher concentration than organophosphates (OPPs) at all sampling sites. Aldrin and lindane were detected with higher frequency and concentration level than other compounds. The concentration levels of detected pesticides were much lower in outlets than at the intake points of water purification plants. water treatment itself may reduce or remove the pesticide residues from water. The concentration level of detected pesticides in Kafr El-Sheikh governorate still lower than the maximum residue limits (MRLs). The powdered activated carbon effectively reduces pesticide residues in drinking water, which promise as water purification technique.

Key words: Drinking water, Pesticide residues, Organochlorine pesticides, organophosphates, removal pesticides, powdered activated carbon.

INTRODUCTION

Pesticide contamination of surface water and ground water from agricultural use has been a concern for a long time. Attention is usually focused on contamination by organochlorine pesticides (OCPs) due to their toxicity and persistence in environment; and contamination by common pesticides, such as organophosphorous pesticides (OPPs) due to misuse and runoffs. Organochlorine pesticides (OCPs) are one of the most persistent organic micropollutants present in water (Gangesh *et. al.*, 2006). They are a possible risk to environment because of their toxicity and ability to bioaccumulation. Because of their highly persistent properties and potential threat to human health, OCPs has prohibited for producing and using in most developed countries and OPPs are used as a substitute for OCPs in many countries nowadays because they can degrade more easily in the environment. Although OPPs as a whole are not the most toxic pollutants, they can be traced in a wide range of surface water. (Chunzhou, *et. al.*, 2005; Sankararamakrishnan, *et. al.*, 2005 and Van Dijk-Looijaard and Van Gendren, 2000)

Pesticide residues reach the aquatic environment through direct runoff, leaching, careless disposal of empty containers, equipment washings, etc. (Miliadis, 1994). Surface water contamination may have ecotoxicological effects for aquatic flora and fauna as well as for human health if used for public consumption (Forney and Davis, 1981; Leonard, 1988; Miyamoto *et. al.*, 1990; Mulla and Mian, 1981). Contamination of ground water resources by pesticides has brought increased environmental concern (Foster et al., 1991; Schiavon *et al.*, 1995; Guzzella *et al.*, 1996; Soutter and Pannatier, 1996; Papadopoulou-Mourkidou *et al.*, 2004). The problem has become more prominent in countries where ground water aquifers constitute the main drinking water resources for rural and adjacent urban areas (Tuxen *et al.*, 2000).

Pollution of surface and ground water is a real risk to human health because of the potential health hazards of their contents of inorganic and organic compounds. Pesticides are group of hazardous compounds that may pollute water due to their extensive application in agriculture as insecticides, fungicides, herbicides, plant growth regulators and sterilants. Although much benefit is obtained from their uses, they have some undesirable side effects such as toxicity, carcinogenity and mutagenity (Becker and Wilson, 1980; Kouras et al., 1998). Adsorption is one of the well-known methods used in removal of such hazardous compounds from polluted water. Organochlorine pesticides remain stable in water for many years after their use Shukla *et al.*, (2006). Due to the long resistance time of organochlorine pesticides in the environment, their removal by different degradations processes not sufficient and high cost. However, their removal by adsorption on activated carbon may be the effective way to overcome their high persistence. Activated carbon is the most widely used adsorbent material for this purpose due to its efficiency and economic feasibility (Yoshida *et al.*, 1993; Zhao *et al.*, 1998).

In Egypt, drinking water limit and maximum permissible level (MPLs) are lacking adequate documentation and continuous revision and they appear to be copied from other existing list lack of logical consistency in limit set for drinking water probably due to the lack of communication between health experts and decision-making authorities. Thus, the main objectives of this study monitor the presences of pesticide residues in surface water in Kafr El-Sheikh governorate, determination their concentration levels, to study the impact of water treatment process on the presence of pesticides in water, to evaluate the activated carbon as technique for pesticide residues removal from drinking water.

MATERIALS AND METHODS

Chemicals

Selected pesticides, organochlorine (aldrin, Lindane (γ-HCH), DDE (1, 1-(dichloro 2,2 bis (4-clorophenyl) ethane), DDD (dichloro-diphenyl-dichloroethane)) and organophosphorus (dimethoate, malathion, methyl parathion, chlorpyriphos and diazinon,) were obtained from the Environmental Protection Agency (EPA), USA.

Petroleum ether, dichloromethane and *n*-hexane as well as anhydrous sodium sulfate were obtained from Merck Co., Germany. The chemicals used were analytical grade for pesticide residues analysis. The used powdered activated carbon having specific surface area (800 m2/g, particle size 40±50 % higher than 40 mm, ash content 15% and iodine number 800.50) obtained from Merck Co., Germany.

Sample Preparation

3 L water samples in cleaned, sterilized and solvent washed glass bottles from each place were collected for a year (one time every three months) from five water purification plants in Kafr El-Sheikh governorate (Kafr El-Sheikh, Fowa, El-Hamoul, Mehalet Abuali and Ebshan). Samples were collected from the intake point of each water purification plant and its outlet (finished treated drinking water). The samples were transferred to the laboratory in ice container. Samples had filtered through fiberglass filter to remove turbidity and debris; and stored at 4 °C prior to extraction.

Rosetta branch feeds the main municipal water purification plants at Fowa and Mehalet Abuali. Demeatta branch divided into Meat yazed canal (which feed Kafr El-Sheikh area) and Terra Sea canal which feed El-Hamoul and Ebshan areas. These sampling sites were selected according to their proximity to residential areas and agricultural activities.

Extraction procedure

500-mL water sample had transferred into a 1 L separatory funnel, and then 60ml mixture of petroleum ether and dichloromethane (70:30 v/v) was added. The separatory funnel was shacken vigorously for about four minutes with periodic venting to release excess pressure. The organic layer was allowed to separate for 10 min. and was collected into a 250 ml flask. A second 40ml of the organic solvent was added and extraction procedure was repeated twice. The combined extract was percolated through an anhydrous sodium sulphate column. The dried extract was evaporated using rotary evaporator adjusted at 35°C until the volume reached 2–3 ml. The final extract had transferred quantitatively by rinsing with 1 ml aliquots of the organic solvent into a concentrator tube and then evaporated to dryness. The residue was dissolved in *n*-hexane and One microliter was injected into the GC in the split-less mode. This method was according to Tahboub, *et al.*, (2005).

Gas chromatograph (HRGC-ECD and NPD)

Residues of the monitored pesticides had analyzed by using a gas chromatograph (GC) model HP-5890 equipped with a tritium electron capture detector (^{3}H-ECD) for detection of chlorinated pesticides. A nitrogen phosphorus detector (NPD) was employed to determine the organophosphorus. Megabore column Hp- 608 part No. 190955-023; (30m x 0.53 mm id, 0.25 µm film thickness) was used. Split injection (0.8 min. hold) was applied with temperature at 220°C. For ^{3}H-ECD the carrier gas used was helium at a flow rate of 2.5 ml/min, the make up gas was nitrogen at 35 ml/min, anode purge, nitrogen at 4 ml/min., temperature was 280°C The initial oven temperature was 80°C (1 min) → (30°C/min) 170°C → (10°C/min) 300°C hold 10 min. For the NPD, the carrier gas used was hydrogen at a flow rate of 4 ml/min. and the make up gas was helium at 30 ml/min with temperature at 225 C. Initial oven temperature was 80°C (1 min) → (25°C/min) 190°C → (2°C/min) 225°C → (5°C/min) 280 hold 20 min. The percentage recovery of organochlorine and organophosphorus pesticides used were >95% and 88%, respectively for all water samples.

Application of powdered activated carbon

Collected water samples from selected sites in winter season were used to evaluate the powdered activated carbon (PAC) for pesticides removal. Accurately weighted carbon doses (20 ±0.1 mg) were added to 1 L of water samples from each site (intake and outlet points). The starting time of the experiment was the time of PAC addition and kept until one hour according to Kouras, *et al.*, (1998). After the addition of PAC, stirring was kept at 60 rpm in order to keep PAC particles sufficiently suspended. Samples were filtered through 0.45 mm membrane filter then extracted and analyzed.

RESULTS AND DISCUSSION

The results of the analysis of the water samples from Kafr El-sheikh governorate have shown the presence of both organochlorine and organophosphate pesticide residues. The compounds detected were aldrrin, lindane, DDE, DDD, Dimethoate, methyl parathion and malathion in water samples at all sampling sites either at the intake or outlet point of each water purification plant but chlorpyriphos and diazinon were not detected in all samples. Results of the sample analysis were summarized in Tables (1-5). The concentrations of organochlorine and organophosphorus pesticides ranged at the intake points from 0.03 to 32.5 and 0.1 to 9.49 ng/l respectively, however at outlet points ranged from 0.01 to 8.89 and 0.24 to 2.84 ng/l respectively.

The concentration range of detected pesticides in Kafr El-Sheikh area was for aldrin (0.03-0.48 ng/l), lindane (0.03-1.09), DDE (N.D.-0.2), DDD (0.07-1.18), Dimethoate (N.D.- 1.15), methyl parathion (N.D.-5.53) and malathion (N.D.-0.91). In Fowa area, the concentration range was for aldrin (0.26-30.39 ng/l), lindane (0.19-32.5), DDE (0.04-0.13), DDD (N.D), Dimethoate (N.D.), methyl parathion (0.1-9.49) and malathion (N.D.-0.74). In El-Hamoul area showed that, the concentration range of detected pesticides was for aldrin (0.08-17.38 ng/l), lindane (4.95-12.22), DDE (0.01-0.1), DDD (1.05-2.05), Dimethoate (N.D), methyl parathion (0.01-1.7) and malathion (N.D.-0.61). The concentration range of detected pesticides in Mehalet Abuali area was for aldrin (0.10-31.4 ng/l), lindane (8.89-19.66), DDE (0.09-0.34), DDD (N.D.), Dimethoate (N.D.), methyl parathion (2.84-3.73) and malathion (N.D.). Finally, the concentration range of detected pesticides in Ebshan area was for aldrin (0.22-8.54 ng/l), lindane (6.32-12.71), DDE (0.05-0.07), DDD (N.D.), Dimethoate (N.D.-1.1), methyl parathion (0.41-7.95) and malathion (N.D.-4.35).

Both the detection frequency and concentration level of organochlorine pesticides such as aldrin and lindane were higher than organophosphorus pesticides. This is due to the high persistence of organochlorine pesticides (OCs) compare to organophosphorus compounds (OPs).

The presence of DDT metabolites (DDD and DDE) instead of DDT due to itself most of the applied pesticides undergo to many transformation processes (Rand *et al.*, 1995). In addition, many pesticides eventually end up in ground water and their transformation products may remain for years (Belfroid *et al.*, 1998).

With the concerning the sampling sites, temporal analysis over a year period showed that, the organochlorine pesticides were abundant in the following order Fowa > Mehalet Abuali > Ebshan > El-Hamoul > Kafr El-Sheikh. However, for organophosphates the abundant were as follow Kafr El-Sheikh > Fowa > Ebshan > El-Hamoul > Mehalet Abuali.

In Kafr El-Sheikh area (Table 1), the level of pesticides residues (ng/l) in descending order was methyl parathion > DDD > dimethoate > lindane > malathion > aldrin > DDE. For fowa (Table 2), the level was lindane > aldrin > methyl parathion. However, in El-Hamoul area (Table 3), the level of residue was aldrin > lindane > methyl parathion > DDD > malathion > DDE. The ranking in Mehalet Abuali (Table 4) depending the residue level was aldrin > lindane > methyl parathion > DDE > DDD > dimethoate > malathion. The concentration level in the last site Ebshan (Table 5) was as follow lindane > aldrin > methyl parathion > malathion > DDE > DDD > dimethoate. Methyl parathion Lindane and aldrine had detected with higher detection frequency and concentration level than other compounds at all sampling area.

Table (1): Mean concentration of detected pesticide residues (ng/L) at intake and outlet of water in Kafr El-Sheikh.

Time of samples	Concentration (ng/L) at intake point						
	Aldrin	Lindane	DDE	DDD	Di.	Me	Ma.
Spring	0.31	1.09	0.2	1.18	1.15	2.33	0.91
Summer	0.48	0.16	N.D	N.D	N.D	N.D	N.D
Autumn	0.09	0.12	N.D	N.D	N.D	N.D	N.D
Winter	0.08	0.12	N.D	N.D	N.D	5.53	N.D
	Concentration (ng/L) at outlet point						
Spring	0.06	0.03	N.D	0.07	N.D	N.D	N.D
Summer	0.18	0.07	N.D	N.D	N.D	N.D	N.D
Autumn	0.03	N.D	N.D	N.D	N.D	N.D	N.D
Winter	0.07	N.D	N.D	N.D	N.D	1.0	N.D

N.D = Not detected, Di=Dimethoate, Me. = Methyl parathion, Ma= Malathion

Organochlorine pesticides (aldrin, endrin and heptachlor) have been reported in water samples collected during the 1980s from the Nile river in a wide range of values (<0.1–228 ng/l), with a decreasing abundance in the order aldrin>heptachlor>endrin (El-Gendy *et al.*, 1991). Higher concentrations were reported at Kafr El Zayat city and at sites on the Rosetta than on Damietta branch. In a study on Nile estuaries 1999 (Abbassy *et al.*, 1999), the concentrations of lindane in Rosetta and Damietta were found in the range from 286-310 and 312-352 ng/l in water samples, respectively.

Table (2): Mean concentration of detected pesticide residues (ng/L) at intake and outlet of water in Fowa.

Time of samples	Concentration (ng/L) at intake point						
	Aldrin	Lindane	DDE	DDD	Di.	Me	Ma.
Spring	7.32	12.71	0.06	N.D	N.D	0.30	0.74
Summer	30.39	32.5	N.D	N.D	N.D	9.49	N.D
Autumn	4.52	9.74	0.13	N.D	N.D	0.1	N.D
Winter	0.44	9.2	N.D	N.D	N.D	N.D	N.D
	Concentration (ng/L) at outlet point						
Spring	0.71	0.23	N.D	N.D	N.D	0.24	N.D
Summer	0.22	7.99	0.04	N.D	N.D	0.67	N.D
Autumn	1.81	N.D	N.D	N.D	N.D	N.D	N.D
Winter	0.26	0.19	0.04	N.D	N.D	N.D	N.D

N.D = Not detected, Di=Dimethoate, Me. = Methyl parathion, Ma= Malathion

Table (3): Mean concentration of detected pesticide residues (ng/L) at intake and outlet of water in El-Hamoul.

Time of samples	Concentration (ng/L) at intake point						
	Aldrin	Lindane	DDE	DDD	Di.	Me	Ma.
Spring	12.03	N.D	N.D	1.05	N.D	1.7	N.D
Summer	17.38	12.22	0.1	N.D	N.D	0.01	0.61
Autumn	9.03	N.D	N.D	N.D	N.D	N.D	N.D
Winter	0.12	N.D	0.03	N.D	N.D	N.D	N.D
	Concentration (ng/L) at outlet point						
Spring	2.09	N.D	N.D	N.D	N.D	N.D	N.D
Summer	0.78	4.95	0.01	N.D	N.D	N.D	N.D
Autumn	N.D	N.D	N.D	2.05	N.D	N.D	N.D
Winter	0.08	N.D	N.D	N.D	N.D	N.D	N.D

N.D = Not detected, Di=Dimethoate, Me. = Methyl parathion, Ma= Malathion

The highest detected concentration during the study period at all sampling area for each detected pesticides was as follow aldrin (31.4 ng/l) at Mehalet Abuali, lindane (32.5 ng/l) at fowa area, DDE (0.32 ng/l) Mehalet Abuali, DDD (1.18 ng/l) at Kafr El-Sheikh, methyl parathion (9.49 ng/l) at Fowa area and malathion (4.35 ng/l) at Ebshan area.

The concentration levels of detected pesticides were much lower at outlet points than intake points and others pesticides had not detected in outlet points. This may due to water treatment processes inside purification plants that remove or reduce the residues of pesticides in water. Spite of, some pesticides still present in drinking water after treatment, their concentration level were much lower than the maximum residue limits

(MRLs) according to Egyptian Standards, 1975. Our results concerning the level of OCs and OPs residues in purified.water are in agreement with those reported by Abd-Allah and Hesham, (2003) and El-Sebae and Abu Elamayem (1978).

Table (4): Mean concentration of detected pesticide residues (ng/L) at intake and outlet of water in Mehalet Abuali.

Time of samples	Concentration (ng/L) at intake point						
	aldrin	Lindane	DDE	DDD	Di.	Me	Ma.
Spring	10.74	16.92	0.14	N.D	N.D	N.D	N.D
Summer	31.4	19.66	0.32	N.D	N.D	3.73	N.D
Autumn	8.4	9.73	0.12	N.D	N.D	N.D	N.D
Winter	0.49	N.D	0.34	N.D	N.D	N.D	N.D
	Concentration (ng/L) at outlet point						
Spring	N.D	N.D	N.D	N.D	N.D	N.D	N.D
Summer	2.49	8.89	N.D	N.D	N.D	2.84	N.D
Autumn	N.D	N.D	N.D	N.D	N.D	N.D	N.D
Winter	0.1	N.D	0.09	N.D	N.D	N.D	N.D

N.D = Not detected, Di=Dimethoate, Me. = Methyl parathion, Ma= Malathion

Table (5): Mean concentration of detected pesticide residues (ng/L) at intake and outlet of water in Ebshan.

Time of samples	Concentration (ng/L) at intake point						
	aldrin	Lindane	DDE	DDD	Di.	Me	Ma.
Spring	4.45	6.32	N.D	N.D	N.D	N.D	N.D
Summer	8.54	12.71	N.D	N.D	N.D	7.95	4.35
Autumn	0.80	N.D	N.D	N.D	N.D	N.D	N.D
Winter	0.11	N.D	0.07	N.D	N.D	N.D	N.D
	Concentration (ng/L) at outlet point						
Spring	1.81	N.D	N.D	N.D	1.1	N.D	N.D
Summer	2.13	N.D	N.D	N.D	N.D	0.41	N.D
Autumn	0.22	N.D	0.051	N.D	N.D	N.D	N.D
Winter	N.D	N.D	0.05	N.D	N.D	N.D	N.D

N.D = Not detected, Di=Dimethoate, Me. = Methyl parathion, Ma= Malathion

The results indicated that DDD and DDE were detected at the outlets during autumn, spite of it not detected in intake points of El-Hamoul and Ebshan areas (table 3 and 5) respectively. These results agree with those reported by Abd-Allah and Hesham (2003).

With the concern to sampling time, it was obvious that, the concentration of identified OCPs and OPPs residues were higher in spring and summer seasons which coincides with the extensine agricultural activities during this period Abd-Allah and Hesham, 2003).

El-Sebae and Abu Elamayem (1978) recorded detectable concentrations of some organochlorine pesticides (e.g., HCB, lindane, heptachlor, p,p-DDT, o,p-DDT) in freshwater samples (raw water, treated water, tap water and wastewater) from Alexandria City, Egypt. Generally, tap water contained pesticide residues higher than those found in the water taken from the plant after treatment.

It is the worth to mention that, most of these organochlorines had virtually phased out many years ago and their presence in water residues from past application and this is due to firstly, the persistent nature of these compounds. Spite of, the organophosphate pesticides in analyzed water, they were not detected in all seasons due to the low stability of these pesticides compare to organochlorine pesticides. Based on our spatiotemporal monitoring, the detected pesticides in drinking water samples collected from different water resources exhibited fluctuations due to residental and agricultural activities along sampling points.

Secondly, the Nile water originates from the African plateau and crosses eight countries before reaching Egyptian territory (e.g., Sudan, Ethiopia, Uganda, Tanzania, Kenya, Zaire, Rwanda, and Burundi). While flowing through these countries, the Nile River is loaded with various types of pesticides and many other contaminants. Thus, it arrives in Egypt after already being contaminated with different pollutants, including the persistent chlorinated pesticides (El-Sebae *et al.*, 1993).

Thirdly, combustion of domestic wastes is a potential source of PTS in the Egyptian environment with a decreasing abundance in the order PAHs>PCBs> DDTs>HCBs>chlordane>HCHs> endosulfan (Barakat, 2003). Finally, the misuse of these pesticides by concerned individuals in addition to the lack of or week national control plants are behind the presence of these pesticides in water. The occurrence of such pesticide residues in drinking water represents an environmental and health hazard. Frequent monitoring program had urgently needed in order to assess health risks associated with such contaminates especially with chronic exposure or a life-long intake of contaminated drinking water.

The results in Table 6 and 7 showed that, the powdered activated carbon (PAC) significantly reduce pesticide residues in winter season samples in both intake and outlet point of each water purification plant. PAC quantitatively reduced the concentration level of detected pesticides from 75 to 100% (such as aldrin fig 1) of their initial concentration level (before PAC addition) at all sampling areas.

Table (6): Mean concentration of detected pesticides before and after activated carbon addition to winter season water samples at intake points

Place of samples	Before treatment (ng/L)						
	Aldrin	Lindane	DDE	DDD	Di.	Me	Ma.
Kafr El-Sheikh	0.08	0.12	N.D	N.D	N.D	5.53	N.D
Fowa	0.44	9.2	N.D	N.D	N.D	N.D	N.D
El-Hamoul	0.12	N.D	0.03	N.D	N.D	N.D	N.D
M. Abuali	0.49	N.D	0.34	N.D	N.D	N.D	N.D
Ebshan	0.11	N.D	0.07	N.D	N.D	N.D	N.D
	After treatment (ng/L)						
Kafr El-Sheikh	0.01	0.02	N.D	N.D	N.D	0.20	N.D
Fowa	0.06	0.1	N.D	N.D	N.D	N.D	N.D
El-Hamoul	0.02	N.D	N.D	N.D	N.D	N.D	N.D
M. Abuali	0.02	N.D	N.D	N.D	N.D	N.D	N.D
Ebshan	N.D	N.D	0.02	N.D	N.D	N.D	N.D

M. Abuali = Mehalet Abuali, N.D = Not detected, Di=Dimethoate, Me. = Methyl parathion, Ma= Malathion

Table (7): Mean concentration of detected pesticides before and after activated carbon addition to winter season water samples at outlet points

Place of samples	Before treatment (ng/L)						
	Aldrin	Lindane	DDE	DDD	Di.	Me	Ma.
Kafr El-Sheikh	0.07	N.D	N.D	N.D	N.D	1.0	N.D
Fowa	0.26	0.19	0.04	N.D	N.D	N.D	N.D
El-Hamoul	0.08	N.D	N.D	N.D	N.D	N.D	N.D
M. Abuali	0.1	N.D	0.09	N.D	N.D	N.D	N.D
Ebshan	N.D	N.D	0.05	N.D	N.D	N.D	N.D
	After treatment (ng/L)						
Kafr El-Sheikh	N.D	N.D	N.D	N.D	N.D	N.D	N.D
Fowa	0.03	0.02	0.02	N.D	N.D	N.D	N.D
El-Hamoul	N.D	N.D	N.D	N.D	N.D	N.D	N.D
M. Abuali	N.D	N.D	N.D	N.D	N.D	N.D	N.D
Ebshan	N.D	N.D	N.D	N.D	N.D	N.D	N.D

M. Abuali = Mehalet Abuali, N.D = Not detected, Di=Dimethoate, Me. = Methyl parathion, Ma= Malathion

The reduced levels of detected pesticides were much lower than maximum admissible concentration of individual pesticides in drinking water according to Egyptian Standards, 1975. The carbon dose used in this study is directly comparable with those previously reported (20/29 mg/L) for the removal of pesticides (Robeck *et al.*, 1965 and Kouras, *et al.*, 1998). The results in this study agree with Erol and Numan (2005) they found that the pesticides such as ametryn, aldicarb, dinoseb and diuron could be removed to a certain extent from aqueous solutions by adsorption onto the high surface area of the activated carbon. It remains to say that, suitable concentration and adequate exposure times are limiting factors determining the efficiency at activated carbon in removal of pesticide residues.

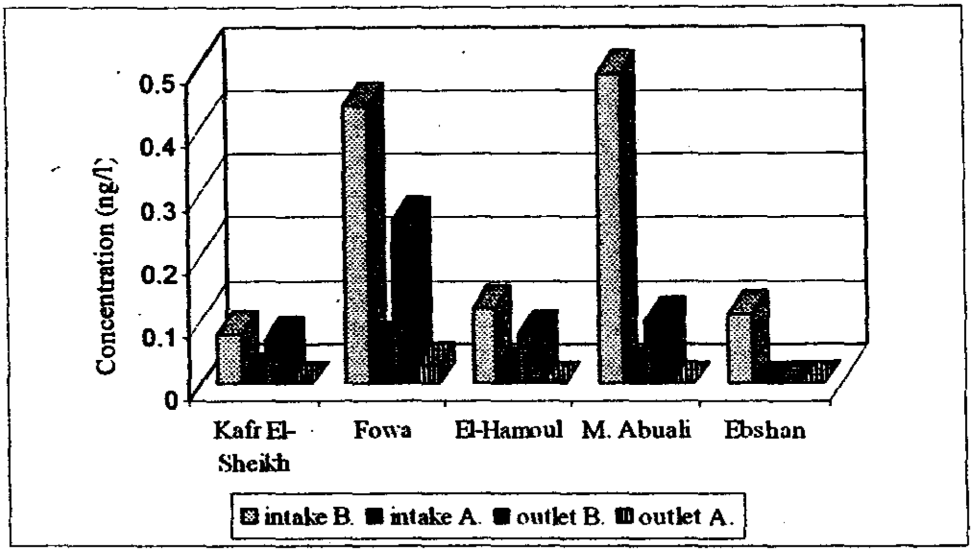

Fig (1): Mean concentration of aldrin after (A) and before (B) activated carbon addition to intake and outlet water.

REFERENCES

Abbassy M.S., H.Z. Ibrahim and M.M. Abu El-Amayem (1999): Occurrence pesticides and polychlorinated biphenyls in water of the Nile river at the Estuaries of Rosetta and Damiatta Branches, North Delta, Egypt. J Environ Sci Health; B34:255 – 67.

Abd-Allah, S. W. and M. G. Hesham (2003): Monitoring of pesticide residues in different sources of drinking water in some rural areas. Alex. J. Agric. Res. 48 (3) 187-199.

Barakat A.O. (2003): Persistent organic pollutants in smoke particles emitted during open burning of municipal solid wastes. Bull Environ Contamin Toxicol, 70(1):174– 81.

Becker, D.L. and S.C. Wilson (1980): Carbon Adsorption Handbook. In: Cheremisinoff, P.N., Ellebush, F. (Eds.), The Use of Activated Carbon for the Treatment of Pesticides and Pesticidal Wastes. Ann Harbor Science Publishers, Michigan. 167–212.

Belfroid A.C.; M. Van Drumen; M.A. Beck; C.A. Vangestal and B. Van Hattun (1998): Relative risks of transformation products of pesticides for aquatic ecosystems. Sci Total Environ. (222) 167– 83.

Chunzhou D.; Z. Zengb and M. Yanga (2005): Determination of organochlorine pesticides and their derivations in water after HS-SPME using polymethylphenylvinylsiloxane-coated fiber by GC-ECD. Water Res. 39 (2005) 4204–4210

Egyptian Standards (1975): Drinking water and their standard method for testing and analysis. High committee for water, p71.

El-Gendy K.S., A.M. Abd-Allah, H.A. Ali, G. Tantawy and A. E. El-Sebae (1991): Residue levels of chlorinated hydrocarbons in water and sediment samples from Nile Branches in the Delta, Egypt. J Environ Sci Health 1991; 26:15– 36.

El-Sebae, A.H. and M.M. Abu Elamayem (1978): A survey of expected pollutants drained to the Mediterranean in the Egyptian Region. In: Proceedings of the xxxvi Congress and Plenary Assembly of the Int. Comm. of Sci. Explor. of the Mediterranean Sea, Antalya, Turkey, pp. 149–153.

El-Sebae, A.H., M. Abou-Zeid, M. and M.A. Saleh (1993): Status and environmental impact of toxaphene in the Third World a case study of African agriculture. Chemosphere 27 (10), 2063–2072.

Erol A. and Numan H. (2005): Adsorption kinetics and isotherms of pesticides onto activated carbon-cloth. Chemosphere (60) 1600–1607

Forney D. and D. Davis (1981): Effects of low concentrations of herbicides on submerged aquatic plants. Weed Sci. 29:677.

Foster S.S.D.; P.J. Chilton and M.E. Stuart (1991): Mechanisms of ground-water pollution by pesticides. J IWEM (5):186–93.

Gangesh S.; A. Kumar; M. Bhanti; P.E. Joseph and A. Taneja (2006): Organochlorine pesticide contamination of ground water in the city of Hyderabad. Environ. International 32 244 – 247

Guzzella A.; C. DePaolis; F. Bartone and P.G. Giulliano (1996): Migration of pesticide residues from agricultural soil to groundwater. Int J Environ Anal Chem (65):261– 75.

Kouras, A., A. Zouboulis, C. Samara and Th. Kouimtzis (1998): Removal of pesticides from aqueous solutions by combined physicochemical processes the behaviour of lindane. Envir. Pollution (103) 193-202

Leonard R. (1988): Herbicides in surface water. In: Grover R, editor. Environmental chemistry of herbicides, vol. 1. Boca Raton, FL, USA7 CRC Press; 45– 87.

Miliadis G.E. (1994): Determination of pesticide residues in natural waters of Greece by solid phase extraction and gas chromatography. Bull Env Contam Toxicol ;52:25–30.

Miyamoto J.; N. Mikami and Y. Takimoto (1990): The fate of pesticides in aquatic ecosystems. In: Hutson DH, Roberts TR, editors. Environmental fate of pesticides. Chichester, England7 Wiley; 123–47.

Mulla M. and L. Mian (1981): Biological and environmental impacts of insecticides malathion and parathion on non-target biota in aquatic ecosystem. Res. Ver. ;78:101– 35.

Papadopoulou-Mourkidou E.; D.G. Karpouzas; J. Patsias; A. Kotopoulou; A. Milothridou and K. Kintzikoglou (2004) The potential of pesticides to contaminate the groundwater resources of the Axios river basin in Macedonia, Northern Greece: Part I. Monitoring study in the north part of the basin. Sci. Total Environ. 321:127– 46.

Rand G.M.; P.G. Wells and L.S. Mclarty (1995): In: Rand GM, editor. Introduction to aquatic toxicology. Washington7 Taylor and Francis; 1995 3 –66.

Robeck, G.C., K.A. Dostal, J.M. Cohen and J.F. Kreissi (1965): Effectiveness of water treatment processes in pesticide removal. J. Amer. Water Works. 57(2), 181±199.

Sankararamakrishnan, N.; A. S. Kumar and R. Sanghi (2005): Organochlorine and organophosphorous pesticide residues in ground water and surface waters of Kanpur, Uttar Pradesh, India. Environ. Int. (31) 113-120.

Schiavon M.; C. Perringanier and J. M. Portal (1995): The pollution of water by pesticides state and origin. Agronomie ; 15: 157– 170.

Shukla G., A. Kumar, M. Bhanti, P.E. Joseph and A. Taneja (2006) Organochlorine pesticide contamination of ground water in the city of Hyderabad. Envir. Inter. (32) 244 – 247

Soutter M. and Y. Pannatier (1996): Groundwater vulnerability to pesticide contamination on a regional scale. J. Environ. Qual (25).439– 44.

Tahboub, Y. R.; F.Z. Mohammad and Z. A. Al-Talla (2005): Determination of the limits of identification and quantitation of selected organochlorine and organophosphorous pesticide residues in surface water by full-scan gas chromatography/mass spectrometry. J. Chromatography A, (1098) 150–155.

Tuxen, N.; P.L. Tuchsen; K. Rugge; H.J. Albrechtren and P.L. Bjerg (2000): Fate of seven pesticides in an aerobic aquifer studied in column experiments. Chemosphere, (41) 1485-1494.

Van Dijk-Looijaard, A.M. and J. Van Gendren (2000): Levels of exposure from drinking water. Food Chem. Toxicol. (38) 37-42.

Yoshida, H., A. Okamoto and T. Kataoka (1993): Adsorption of acid dye on cross-linked chitosan fibers: equilibria. Chem. Eng. Sci. 48, 2267–2272.

Zhao, X.S., Q. Ma and G.Q. Lu (1998) VOC removal: comparison of MCM-41 with hydrophobic zeolites and activated carbon. Energ. Fuel. 12, 1051–1054.

الملخص العربى

تتبع متبقيات المبيدات وازالتها فى مياه الشرب التى تم تجميعها من محافظة كفر الشيخ بجمهورية مصر العربية

محمد على عشرى، عثمان شكرى بيومى، أسماعيل ابراهيم الفخرانى، على سليمان دربالة
أحمد عبد الحميد ابوزيد إسماعيل

قسم المبيدات ـ كلية الزراعة ـ جامعة كفر الشيخ

يؤدى الاستخدام المتزايد للكيماويات الزراعية وخاصة المبيدات الى تسربها ووصولها الى مصادر المياة السطحية والجوفية مما يشكل خطورة صحية وبيئية فى اجزاء مختلفة من العالم. فى هذه الدراسة تم اجراء رصد مكانى وزمانى للمبيدات فى مصادر مياة الشرب قبل وبعد معاملتها فى المحطات المختارة فى محافظة كفر الشيخ وايضا تم تقيم الفحم (الكربون النشط) كطريقة للتخلص من متبقيات المبيدات فى مياة الشرب سواء قبل او بعد معاملتها فى محطات التنقية. واوضحت نتائج تحليل العينات وجود متبقيات للمبيدات الكلورينية الالدرين واللندين والـ DDD و الـDDE والمركبات الفوسفورية الداى مثويت و الميثايل باراثيون والملاثيون. المركبات الكلورينية التى تم اكتشافها كانت اعلى فى التركيز من متبقيات المبيدات الفوسفورية العضوية. الالدرين واللندين تم اكتشافهم بتركزات عالية بالمقارنة بالمركبات الاخرى كما وجد ان عمليات المعالجة للمياة فى داخل محطات التنقية يمكن ان تزيل او تقلل من تركيزات المبيدات فى المياة. مستوى تركيز المبيدات المكتشفة فى محافظة كفر الشيخ يبقى اقل من الحد الاقصى للتركيز المسموح به فى مياه الشرب. الكربون النشط ادى الى انخفاض فى تركيزات المبيدات فى مياة الشرب بدرجة كبيرة مما يثبت انها طريقة فعالة فى تنقية المياة.