J. Agric. Sci. Mansoura Univ., 34 (7): 8201 - 8205, 2009

REMOVAL OF PESTICIDES CONTAMINATION IN DRINKING WATER BY NATURAL ADSORBENTS : AS A PRACTICAL TOOLS .

Hussein, A. A. *; Y. A. Ragheb * and A. A. Abdel – Gawad**

*** Central Agricultural pesticides Lab. (CAPL), Agricultural Research Center, Ministry of Agriculture, Egypt.**

**** Plant Protection Department, Faculty of Agriculture, Benha University**

ABSTRACT

Removal of pesticide residues from water samples was done in the laboratory by using physical methods such as micronized charcoal powder, plant charcoal, peanut crushed shells and zeolite. Most efficient adsorbent recommended for the removal of pesticide residues was micronized charcoal powder followed by plant charcoal and peanut crushed shells. The average of removal percentages for organochlorine pesticides (OCPs) were 92.7 , 89.5, 88.9 and 76.8% for micronized charcoal, plant charcoal, peanut crushed shells and zeolite, respectively. The highest efficiency of zeolite was obtained in the case of dieldrin and *P,P'*-DDE (100%), but it was ranged between 77.4 and 83.3 % for orga nophosphorus Pesticides (OPPs), It is recommended to use these natural adsorbents in water remediation as a practical tools in a small scales

INTRODUCTION

Water is a basic and essential component of life. Life could not have been created without water and will not continue without it. Providing safe water for people is important for their health and well being. Guidelines for pesticide residues in drinking water have been described by WHO to describe the quality of water that is suitable for drinking purposes under all circumstances. It in intended that these guidelines should be applied in developing national standards, not only for community piped water supplies but for all water used for drinking purposes, including that obtained from community standpipes and wells and drinking water distributed by tankers or in bottles.

EPA has set standards for more than 80 organic and inorganic contaminants that may occur in drinking water and pose risk to human health. Chronic effects occur after a persons consume a contaminant at levels over EPA's safety standards for long period of time. The contaminant that can have chronic effects are chemicals, which have the bioaccumulation effects (e.g. pesticides, heavy metals and others) (USEPA, 2001) .

Several studies were done to establish the efficacy of some adsorbents to remove pesticides from water (e.g. Burke *et al.*, 1981, Mullins *et al.*, 1988, Abdel- Razik *et al.*, 1990, DWI, 1991 and Hutchinson *et al.*, 1993). Thus, this study aims to use some natural materials as adsorbents of chemical contaminants wastes in drinking water under laboratorial programs .

MATERIALS AND METHODS

These experiments were conducted in the laboratory to investigate the effect of some different physical methods for diposal of pesticides wastes from water. *n*- hexane, anhydrous sodium sulphate and aluminum

oxide were obtained from BDH, Lt.d company. Organochlorine pesticides, reference standard : HCH isomers (α,β,and γ) aldrin, heptachlor *P,P'* – DDE. dieldrin and *O,P'*– DDD .were obtained form Applied Science Cat. No. ea 584. organophosphorus pesticides, chloropyrifos and chloropyrifos- methyl were obtained from Dow company, Milford, USA .

Removal of pesticides by using:

1.Demicorizied charcoal powder

One liter of drinking water was spiked with each 0.05 and 100 ppm for organochlorine (OCPs) and organophosphorus (OPs) respectively, sample was filtrated through glass column (30× 2.5 cm) packed with 5% cm (length) of sandwiched between two layers of glass wool. Collected demicronized charcoal powder. Extract was taken for pesticides residues analysis.

2. plant charcoal.

The plant charcoal was ground and sieved from 10 mesh sieve. Spiked samples was filtrated through analytical column packed with 10 cm length of plant charcoal .

3. peanut crushed shell.

The shells were washed by distilled water and dried at oven set at 60 °C for overnight. The adsorbent was ground and sieved from 30 mesh sieve and used in a packed column at length of 10 cm.

4. Zeolite rock.

The rock was ground and sieved from 80 mesh sieve.The column was packed with adsorbent for length of 5 cm. The filtration procedure needs approximately four hours, A drinking water with any treatment was used as a control.

Pesticide residues analysis.

50 ml of *n*- hexane were added to 1L of water and skated for 30min. The organic layer was separated and passed through anhydrous sodium sulphate. The procedure was repeated, the organic layers were combined and evaporated to 1ml by rotary evaporator set at 40 °C. The sample was loaded on an analytical column packed with 1 g of aluminum oxide (deactivated with 1% H_2O) and eluted with 8 ml of *n*- hexane. The extract was concentrated to1 ml for gas chromatography determination .

GC- condition.

GC tracor- 222 equipped with Ni^{63} –electron capture detector (ECD) was used. The analytical glass column (6 ft x4 mm) was packed with 4% SE 30/ 6% OV 2/0 on Chromasorb Q (80-100 mesh). The column oven and injection port were operated at 200°C, while the detector was set at 300°C. The flow rate of nitrogen was 35 ml / min with a detector sensitivity range of 50 to 100 .

Standard solutions and precautions were done in the analytical procedures to avoid any contamination. The detection limits of tested pesticides were ranged from 50 – 100 pg. But the recovery percentages were ranged from 64.2 to 88.5%.

RESULTS AND DISCUSSION

Removal of pesticide residues from water samples using different adsorbents are explained that data in tables (1 and 2). The results indicated that the most efficient adsorbent recommended for the removal of pesticide residues was micronized charcoal followed by plant charcoal and peanut crushed shells. the average of removal percentages for OCPs was 92.7, 89.5, 88.9 and 76.8 % for micronized charcoal, plant charcoal, peanut crushed shells and zeolite, respectively. In case of OPs, it was 95.5 , 80.4 , 73.9 and 71.4% for micronized charcoal, zeolite, plant charcoal and peanut crushed , shells, respectively .

The highest efficiency of zeolite was obtained in the case of dieldrin and *P,P'*-DDE (100%), while the lowest was for β-HCH (28.9%). On the other hand, there was no considerable differences in the removal of chloropyrifos between peanut crushed shells, micronized and plant charcoal. Zeolite was the lowest efficient for chloropyrifos removal (Table 2). Concerning the removal of OPs from water samples, zeolite was the most efficient tested adsorbent, where the rate of adsorption ranged between 77.4 and 83.3% The efficiency of peanut crushed shells for removing OCCs ranged between 71.1 and 100%, while for Ops it ranged from 48.1 to 94.6% .

Our data are in agreement with that showed by (Zayed *et al.*, 1994. Thacker *et al.*, 1997 and Keerthinarayana and Bandypoadhyay, 1997) However, activated plant charcoal is the most efficient for pesticide removal from water especially OCPs. On the other hand, Scott (2001) mentioned that zeolite is most efficient for OPs compounds in contrast with that previously obtained in our study.

A major advantage of this proposed process is in the potontential safety of these materials . Concentration of pesicides on a solid matrix facilitate the ease of handling and spills could be more easily managed than in liquid from (mullins *et al.,* 1993).

Generally, we can say that, based on the available information and to avoid hazard and human health impact from exposure to contaminated water, the adsorbent material must be used as a practical tools in risk management programs. Also, in a personal case , it is useful and low cost facilities in houses and small building to apply for providing ruther safe drinking water for drinking and other domestic purposes.

Table (1) : The efficiency of different adsorbents for removing organochlorine pesticides in water samples .

Pesticides	Demicronized charcoal powder			plant charcoal			Peanut crushed shell			Zeolite rock		
	Initial (ppb)	Final (ppb)	% of removing	Initial (ppb)	Final (ppb)	% of removing	Initial (ppb)	Final (ppb)	% of removing	Initial l(ppb)	Final (ppb)	% of removing
α-HCH	50	1.88	96.3	50	8.13	83.8	50	8.13	83.8	50	21.88	56.3
Lindane	50	2.24	91.5	50	9.32	81.4	50	7.63	84.8	50	8.48	83.1
β-HCH	50	9.62	80.8	50	9.62	80.8	50	6.73	86.5	50	35.58	28.9
aldrin	50	6.66	86.7	50	3.35	93.3	50	28.9	71.1	50	15.56	68.9
Heptachlor epoxide	50	ND	100	50	5.00	90.0	50	2.86	94.3	50	2.86	94.3
P,P'- DDE	50	ND	100	50	6.66	86.9	50	4.17	91.3	50	ND	100
dieldrin	50	ND	100	50	ND	100	50	ND	100	50	ND	100
O,P'–DDD	50	6.82	86.4	50	ND	100	50	ND	100	50	9.10	81.8
Average %	—	—	**92.7**	—	—	**89.5**	—	—	**88.9**	—	—	**76.8**

Table (2) : The efficiency of different adsorbents for removing of organophosphorus pesticides in water samples .

Adsorbents	Pesticides						Mean of % removing
	chloropyrifos			chloropyrifos – methyl			
	Intial (ppm)	Final (ppm)	% of removing	intial (ppm)	Final (ppm)	% of removing	
Demicronized charcoal powder	100	ND	100	100	9.1	90.9	95.5
Plant charcoal	100	48.5	51.5	100	3.6	96.4	73.9
Peanut crushed shells	100	51.9	48.1	100	5.4	94.6	71.4
Zeolite	100	22.6	77.4	100	16.7	83.3	80.4

REFERENCES

Abdel-Razik, M.R.I El-Metwally, M.A.H. and Abdel- kader, M.A. (1990). Dislodging of organochlorine insecticide residues from water by different treatments. Bull. Fac. Of Agric.,Univ. of Cairo 41, (2): 427-434.

Burke, T., Hyde, R.A. and zabel, T.F. (1981). The performance and cost of activated carbon for control of organics. J. Instn. Wat. Engrs.Scien., (C.F. principles of water quality control, 3rd Edition, pp. 182-184).

DWI (1991). Removal of pesticides by GAC and GAC/ oxidants. Final report to the drinking water inspectorate department of the environment DOE 2922 DWI 0787.

Hutchinson, L.E., Berry, D.F.I Mullins, D.E., Gelen, H.H. and Rodrick, W.Y. (1993). Evaluation of economical sorbents for removal of metalochlor from Rensate wastewater. Waste Management, Vol. 13, pp. 83-87 .

Keerthinaryana, s. and Bandyopadhyay, M. (1997). Sorption and adsorptions of lindane by wood charcoal in fixed- bed detector. J. Environ. Sci. Health B 32 (5): 701-727.

Mullins, D.E., Roderick, W.Y, Christopher, P.P., Robert L.H. and Peter, C.S. (1988). Disposal of content rated solution of diazinon using organic adsorption and chemical microbial degradation. Pestic. Sci. 25, 24 -54.

Scott, L.C. (2001). Using zeolites to remove malathion, carbofuran and carbaryl from water. Univ of Maine .

Thacker, M.V., Vaidya, M.S. and Kalra, A. (1997). Removal technology for pesticide contaminants in potable water. J. Environ. Sci. Health, B 32, (4): 483-496.

USEPA (2001). Water quality standard. Environmental protection Agency. http :// www.epa.gov/sulewaler/htm/.

Zayed, S.M.A., El-Arab, A.E. and Soliman, S.M. (1994). Dissipation of DDT in natural water under field condition. J. Environ. Sci. Health, B 29, (1): 185-188.

Mullins , D.E, young , R.W , Berry ,D.F , Gu , J .D, Hetzel , G.H , Racke, K.D. and leslie , A.R .(1993) . Biologically based sorbents and their potential used in pesticide waste disposal during composting . pesticides in urban Environments : fate significance , 113-126 .

إزالة التلوث بالمبيدات في مياه الشرب باستخدام مواد طبيعية كوسيلة تطبيقية.

علاء عبد الفتاح حسين* ، يوسف عدلى راغب* و أحمد عبد الوهاب عبد الجواد**

* المعمل المركزي للمبيدات – مركز البحوث الزراعية – وزارة الزراعة – مصر

** قسم وقاية النبات – كلية الزراعة – جامعة بنها

تم إزالة المبيدات من الماء تحت ظروف معملية وذلك باستخدام مواد لها قدرة امتصاص عالية مثل الفحم النشط الدقيق ، الفحم النباتي – قشر الفول السوداني – صخر الزيوليت. أعلى إزالة يمكن ان يوصي بها كانت استخدام الفحم النشط الدقيق ثم الفحم النباتي وأيضا قشر الفول السوداني وكان متوسط نسبة الازالة للمركبات الهيدروكلورينة ٩٢,٧ ، ٨٩,٥ ، ٨٨,٩ ، ٧٦,٨% وذلك للفحم النشط الدقيق ، الفحم النباتي ، قشر الفول السوداني والزيوليت على التوالي. وكانت أعلى كفاءة للزيوليت كانت في حالة مركبي الداي الدرين ، الـ DDE وكانت ١٠٠% بينما كانت في مدى من ٧٧,٤ إلى ٨٣,٣% بالنسبة لمركبات الفسفور العضوية . هذه المواد الطبيعية يوصى باستخدامها فى تنقية عفان المياه كوسيلة تطبيقية في المنازل والاستخدام الشخصي .