Pakistan J. Sci. Ind. Res., Vol. 31, No. 11, November 1988

PESTICIDE RESIDUES IN THE RIVER NILE WATER, EGYPT

M. Abdel-Razik, M.A.H. Marzouk*, L.E. Mowafy* and M.A. Abdel-Kader*

Central Agricultural Pesticides Laboratory, Agriculture Research Centre, A.R.E.

(Received July 14, 1988; revised November 22, 1988)

Duplicate water samples of El-Abbasa drinking water station were collected monthly before and after purification treatments during the period February through June, 1986. Organochlorine pesticide residues were determined in the collected samples using electron-capture gas chromatographic detector. Residue analysis revealed that the pesticides detected in purified and nonpurified water were α-BHC, Lindane, Aldrin, Dieldrin, Endrin and P,P'-DDT. It was noticed that the mean value of α-BHC, Lindane and Aldrin were comparatively higher in purified water than in nonpurified water. Moreover, the average levels of dieldrin, endrin and P,P'-DDT in drinking water were less than in surface water. The average levels of pesticides detected in purified and nonpurified water were below the maximum permissible levels. No residues of Chlordane were detected in water samples before and after purification treatments.

Key words: Pesticides, Residues, River Nile.

INTRODUCTION

Man and animals are exposed to uptake of pesticides from air, food and water. Surface water contains appreciable amounts of persistent organochlorine insecticides [2, 7]. In an intensive study of pesticides in drinking water from the Mississippi and Missouri rivers [12], 500 grams of finished drinking water and raw water were assayed. Only endrin (23 samples), Chlordane (5 samples) and dieldrin (one sample) were found in concentrations that exceeded the suggested maximum permissible amounts Organochlorine pesticides has been detected in numerous drinking water supplies [1, 6, 10, 11, 13], thus presenting a possible health hazard to population.

The present work was conducted to assay chlorinated pesticide residues in water from the River Nile at El-Abbasa drinking water station in Sharkia Governorate before and after purification treatments.

MATERIALS AND METHODS

A total of 10 water samples of El-Abbasa drinking water station were taken monthly before and after purification treatments during the period of February to June, 1986. The purified water samples were taken from tap inside the station and after 30 minutes post-chlorination (1-1.2 ppm). The tap was opened for running water 5 minutes before taking the samples.

Extraction and cleanup of the collected water samples were carried out according to the method [5], as follows:

A measured volume, one litre, of sample was transferred into 2-liter separatory funnel, then 10ml saturated sodium chloride solution was added. The sample was extracted three times using 60ml of 15% methylene chloride in hexane. The combined extracts were dried through anhydrous sodium sulphate and collected in 500ml round-bottom flask. The extract was then evaporated to dryness using rotary evaporator at 40°. The residues in the evaporating flask were dissolved in 5ml of hexane and transferred to a florisil column containing 2g. anhydrous sodium sulphate, 6g. activated florisil and 2g. anhydrous Na_2SO_4. The flask was rinsed three times, 5ml hexane each, then transferred to the column. The column was eluted with 200ml of 15% methylene chloride in hexane at the rate of 3-4 drops per second. The eluate was evaporated till dryness and the residue dissolved in a known volume of nanograde hexane and determined using a Pye-Unicam 104 gas chromatograph equipped with electron capture detector (ECD, Ni^{63}) under the following conditions:

Column: A 7 ft long and 4 mm od. coiled glass column packed with 1.5% OV-17 + 1.95% OV-210 on gas chromosorb Q (80-100 mesh).

Temperatures: Column and injector were 220° and 230° for detector.

Gas flow rate: Nitrogen was 120 ml/min.

Results were corrected according to the average rates of recovery (Table 1) which were estimated by adding known amounts of the authentic compounds to one liter distilled water using the same technique mentioned above. Each residue figure represents an average of five samples.

---

* Department of Hygiene and Preventive Medicine, Fac. of Vet. Med., Zagazig University.

RESULTS AND DISCUSSION

Table 1. The percentage rates of recovery of chlorinated pesticides from distilled water.

Pesticide	Micrograms added	Percentage of recovery
α-BHC	4	93.10
Lindane	4	92.50
Aldrin	4	72.72
Chlordane	4	100.00
Dieldrin	4	100.00
Endrin	4	75.00
P,P'-DDT	4	100.00

Table 2. Organochlorine pesticide residues detected in the River Nile water at El-Abbasa station before and after purification treatments during the period of February to June, 1986.

	Pesticide residues (ng/liter)	
Pesticide	Before treatments	After treatments
α-BHC	4.0776 ± 1.3529	6.4651 ± 1.6820
Lindane	3.6882 ± 1.6201	5.4916 ± 1.4939
Aldrin	21.6737 ± 9.0397	24.2624 ± 7.0812
Chlordane	UN	UN
Dieldrin	8.1099 ± 4.1196	7.7941 ± 3.6249
Endrin	3.5069 ± 1.4467	1.8447 ± 1.2863
P,P'-DDT	15.4117 ± 8.4176	5.4160 ± 2.3066

UN: Non detectable.

The organochlorine residues in water before and after purification treatments in El-Abbasa station of drinking water (Table 2), revealed that the mean values of α-BHC, lindane, and aldrin in water samples collected before purification treatments were 4.0776 ± 1.3529, 3.6882 ± 1.6201 and 21.6737 ± 9.0397 ng/liter, respectively. The mean value of dieldrin was 8.1099 ± 4.1196 ng/liter, endrin was 3.5069 ± 1.4467 ng/liter and P,P'-DDT was 15.4117 ± 8.4176 ng/liter. No amounts of chlordane were detected in water samples before and after purification treatments. similar findings of organochlorine residues in raw surface water were obtained by other researchers [2, 4, 7].

Concerning organochlorine residue levels in purified water, the mean value of α-BHC, lindane and aldrin were 6.4651 ± 1.6820, 5.4916 ± 1.4939 and 24.2624 ± 7.0812 ng/liter, respectively. The average of dieldrin in drinking water was 7.7941 ± 3.6249 ng/liter. The mean values of Endrin and P,P'-DDT were 1.8447 ± 1.2863 and 5.4160 ± 2.3066 ng/liter, respectively. The results obtained for organochlorine residues in purified water are in agreement with those reported [1, 2, 6, 10, 12, 13].

The results, showed that the mean value of α-BHC, lindane and aldrin were comparatively higher in treated water than in the untreated water. Moreover, the average levels of dieldrin, endrin and P,P'-DDT in drinking were low in un-treated water. The chlorine used to disinfect drinking water may combine with organic compounds and result in elevated levels of a variety of chlorinated compounds [9]. Moreover, coagulation, sedimentation and filtration of water will remove 80-98% of 0.1-10.0 ppm DDT [3].

These results indicated that drinking water contained organochlorine residues well below the maximum permissible levels, recommended for Water Quality Criteria [1]. Moreover, the desirable limit for each pesticide in drinking water was absent [8]. For the maximum protection of human health from the potential hazardous effect due to exposure to aldrin, dieldrin and DDT through the drinking of contaminated water, United States Environmental Protection Agency (1980) reported that pesticide residue level in concentration should be zero. However, zero level may not be attainable at present time.

Therefore, the levels which may result in an incremental increase of cancer risk over the lifetime for aldrin, dieldrin and DDT were 0.74, 0.71 and 0.42 ng/liter, respectively.

The results indicated higher levels of α-BHC, lindane and aldrin residues in water after purification treatments which may be attributed to combination of chlorine, used in the treatment of drinking water. Moreover, coagulation, sedimentation and filteration decreased the levels of DDT, dieldrin and endrin.

REFERENCES

1. A. Bevenue, J.W. Hylin, Y. Kawano and T.W. Kelly, Pesticides Moint. J. 6(1), 56-64 (1972).
2. N.V. Brodtmann, Bull. Environ. Contam. Toxicol., 15(1), 33-39 (1976).
3. J.A. Carollo, J. Amer. Water Work Ass. 37, 1310 (1945).
4. B.T. Croll, Part I.J. Water Treat. Exam. 18, 255-274 (1969).
5. J.J. Lichtenberg, Environmental Monitoring and Support Lab. U.S. Environmental Protection Agency, Cincinnati, Ohio 45268 (1978).
6. E.E. Mcneil, R. Otson, W.F. Miles and F.J.M. Rajabalee, J. Chrom, 132, 277-286 (1977).
7. J.R.W. Miles and C.R. Harris, Pesticides Moint. J. 6(4), 363-368 (1973).

8. H.P.Nicholson, Proc. Wash. Acad. Sci., **59**(4-5), 85 (1969).
9. J.J. Rook, **23**, 234 (1979) (Cited after Badawy, 1982).
10. L. Rosival and A. Szokolay, Pesticide Chemistry-3 third International Congress of Pesticide Chemistry Including the Symposium on Dispersion Dynamic of Pollutants in the Environment, London, Butterworths p. 167-176 (1975).
11. M. Sackmauerova, O. Palusova and A. Szokolay, Water Research, **11**, 551-556 (1977).
12. M.L. Schafer, J.T. Peeler, W.S. Gardner and J.E. Campbell, Environ. Sci. Technol., **3**(12), 1261-1269 (1969).
13. D.T. Williams, F.M. Benoit, E.E. Mcneil and R. Otson, Pestic. Monit. J., **12**(3), 163 (1978).