Bangladesh J. Sci. Res. 25(1): 93-98, 2012 (June) **Short communication**

PESTICIDE RESIDUES IN SOME SELECTED POND WATER SAMPLES OF BANGLADESH

M. Amin Uddin*, M. A. Auwal[1], M.A.Z. Chowdhury, M. A. Rahman and M. K. Alam

Institute of Food and Radiation Biology, Atomic Energy Research Establishment, Gonakbari, Savar, GPO Box- 3787, Dhaka- 1000. [1] Dept. of Biochemistry and Molecular Biology, Jahangirnagar University, Dhaka.

This study was undertaken to investigate the presence of pesticide residues in some selected pond water samples of Bangladesh. Twenty five water samples were collected and analyzed by high performance liquid chromatography (HPLC) technique to determine the concentration levels of residues. The results indicated that some water samples contain different concentrations of organophosphorus, carbamate and pyrethroid insecticide residues. The residue level of malathion ranged from 0.0241 to 0.0463 ppm. Among carbamate pesticides, carbaryl was not detected but carbofuran was found in two samples that ranged between 0.0302 and 0.0629 ppm. Cypermethrin (pyrethroid) was the most frequent residue observed in this investigation and was detected in four samples which ranged from 0.0141 to 0.0900 ppm. The residue level was within the range as compared to the IAEA/FAO/Codex Alimentarious Guide line value of water quality.

Use of pesticides in Bangladesh is still low (300 g active ingredient/hectare) as compared to other countries of the world. This is even lower than India (380 g a.i/hectare).

However, consumption of pesticides has increased in recent years with the introduction of high yielding varieties of rice. About 25,479 tons formulated products were used in 2005 compared with 15,906 tons in 2001 and 18,090 tons in 2003 (Rahman 2007).

Although pesticide is beneficial for pest control but it also poses a harmful effect to our environment such as the pollution of pond water. After application in the crop field the pesticide is degraded in the soil by the soil microorganism to some extent but many of the toxic pesticides are transported into surface and groundwater by agricultural run off rain water from the crop field. Ultimately, the surface and groundwater might be highly contaminated due to this agricultural run of pesticide (Bagchi *et al.* 2008).

The indiscriminate use of pesticides has created very serious health and environmental problems in many developing countries. World-wide, one to five million farm workers are estimated to suffer pesticide poisoning per year. Most poisonings take place in rural areas of developing countries. Although developing countries use 25% of

*Corresponding author. E-mail: aminifrb@yahoo.com

the world's production of pesticides, they experience 99% of the deaths due to pesticide poisoning (WHO 2004). So, the levels of pesticide residues in various environmental samples should be monitored routinely, and effective measures must be adopted to control the use of pesticides to save the surface water as well as to minimize human health hazards. Pesticide residue problem would become a chronic problem if proper measures are not taken in time. And certainly, if the residue levels in drinking water as well as in water environment exceed the maximum residue limit (MRL), it will cause health hazards (Aminuddin *et al.* 2004). Hence, the present study was undertaken to investigate the extent of contamination from pesticide residues and their concentration levels in water samples of different locations and propose a sound recommendation for minimizing the pesticide contamination of pond water in those locations of Bangladesh.

Nabinagar upazila (south zone) under Brahmanbaria district has been taken as the study area and the sampling locations are spreaded in five unions viz, Shibpur, Bitghar, Shyamgram, Ibrahimpur and Satmura union of this Upazila. Figure shows the sampling areas. Water samples were collected from different ponds of five unions under Nabinagar Upazila of Bangladesh (Figure 1). Samples were then taken to the laboratory as quickly as possible in glass containers and kept in refrigerator until extraction. Extraction of water sample (500 ml each) was performed with 100 ml double distilled hexane in a separatory funnel with shaking for 5 minutes. Two further extractions with 25 ml hexane were done. The combined hexane extract was treated with 5 g anhydrous sodium sulphate to remove traces of water. The extract was vacuum evaporated in a Rota vapor and followed by complete evaporation of solvent under a mild stream of nitrogen. The extract was subjected to clean-up using florisil column chromatography (DFG Manual of Pesticide Residue Analysis, 1987). The top 1.5 cm of the florisil column was packed with anhydrous sodium sulphate. Elution was done with 2% diethyl ether in hexane (5 ml/min). The eluate was concentrated in a Rota vapor and was dissolved in acetonitrile and then made to volume 1-2 ml for HPLC. Injections of the aliquots (usually 20 µl) were done by micro syringe into HPLC. Tentative identification of the suspected pesticide was carried out in relation to the retention time of the pure analytical standard supplied by International Atomic Energy Agency. Quantification was made with a freshly prepared standard curve of the relevant (standard) pesticide. Analysis was done by HPLC (Detector-Waters 486, Pump- waters 515).

According to the results of this study, three samples were found to be contaminated with organophosphorus (Malathion) insecticide residues, one from Bitghar union (WS-07; 0.0463 ppm), another from Shibpur union (WS-19; 0.0241 ppm), and the last one from Shyamgram union (WS-23; 0.0314 ppm). The concentration level of malathion was found within the WHO guideline value of water quality (0.04 ppm). Fenitrothion,

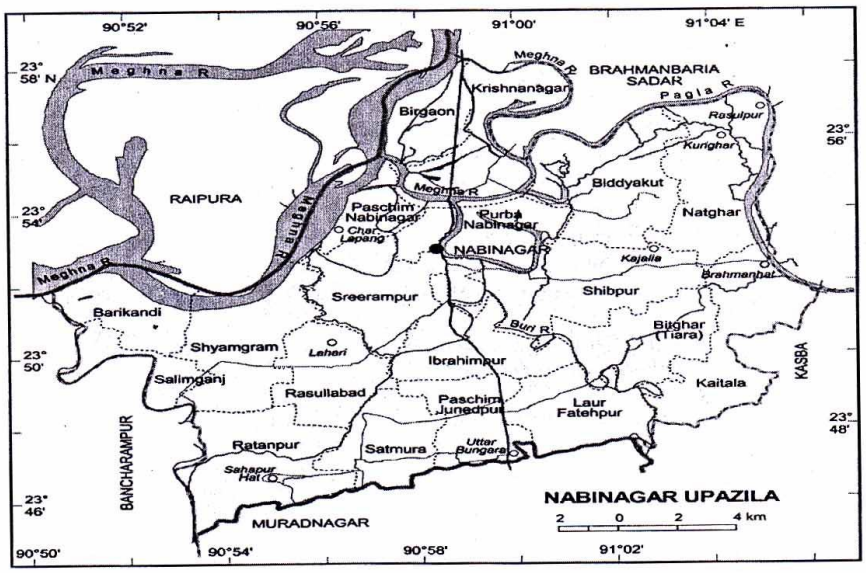

Figure 1. Sample Collection Areas of Nabinagar Upazila under Brahmanbaria district (Indicated by areas inside boxes).

fenthion and diazinon were not detected in any of the samples (Table 1). This result matches the survey data which suggests the widespread use of malathion by the farmers of areas under investigation. Similar findings were reported by Fatta *et al.,* (2007) in their study. Survey data of the present study indicates that no organochlorine but organophosphate, carbamate, and pyrethroid pesticides have been applied by the farmers in the cultivating areas of Nabinagar upazila. Organochlorines are restricted in agricultural use due to their long persistency in environment. Also, these insecticides are extreme lipophilic nature and resistance to biodegradation, which results in their accumulation and concentration in fatty tissues (Chowdhury *et al.* 2010). On the other hand, local authorities have taken initiatives to raise awareness among the farmers and also encourage them to use synthetic pyrethroid pesticides instead of others because of its less detrimental impacts on environment and public health.

Cypermethrin; a synthetic Pyrethroid was the most identified pesticide in the current investigation. The survey data also showed the extensive use of cypermethrin by the farmers of Nabinagar upazila. Four water samples were found to be contaminated with cypermethrin (Table 1). The first two samples were obtained from Ibrahimpur union (WS-14; 0.0360 ppm and WS-17; 0.0900 ppm). Another one from Shibpur union (WS-

22; 0.0639 ppm) and the last one was obtained from Shyamgram union (WS-25; 0.0141 ppm). According to WHO guideline value of water quality these samples were within the acceptable range (0.09 ppm). Cypermethrin is highly toxic to aquatic life, bees, and birds (National Pesticide Information Center, 1998.). Among carbamate group, Carbofuran was identified in two water samples; one from Bitghar union (WS-06, 0.0302 ppm) and another from Shyamgram union (WS-23, 0.0629 ppm). The results are presented in Table 1. However, residual levels of Carbofuran were fairly below the WHO guideline values (WHO, 1993) of water quality (0.07 ppm). This suggests that both carbofuran and carbaryl might not be frequently used by the local farmers of the selected areas, or might be used in a well-controlled manner. Carbamate pesticides are degraded in water by hydrolysis, microbial decomposition and photolysis (WHO 2003, Thapar *et al.* 1995).

Table 1. Amount of organophosphorus, carbamate and pyrethroid pesticide residues in pond water samples.

Sample No.	Organophosphorus, carbamate and pyrethroid pesticide residues in water samples (ppm)		
	Malathion	Carbofuran	Cypermethrin
WS1	ND	ND	ND
WS2	ND	ND	ND
WS3	ND	ND	ND
WS4	ND	ND	ND
WS5	ND	ND	ND
WS6	ND	0.0302	ND
WS7	0.0463	ND	ND
WS8	ND	ND	ND
WS9	ND	ND	ND
WS10	ND	ND	ND
WS11	ND	ND	ND
WS12	ND	ND	ND
WS13	ND	ND	ND
WS14	ND	ND	0.0360
WS15	ND	ND	ND
WS16	ND	ND	ND
WS17	ND	ND	0.0900
WS18	ND	ND	ND
WS19	0.0241	ND	ND
WS20	ND	ND	ND
WS21	ND	ND	ND
WS22	ND	ND	0.0639
WS23	0.0314	0.0629	ND
WS24	ND	ND	ND
WS25	ND	ND	0.0141

W = Water, S = Sample, ND = Not Detected

The results of this study suggest that the water quality is becoming contaminated in terms of pesticide residues. This study can only provide some baseline data which

deserves further investigation. However, a continuous monitoring of residual pesticides' level in different environmental samples and food materials are obvious to understand the trend of contamination. Consequently, new and vital control systems are expected to be implemented by the authorities as far as possible in the different parts of Bangladesh to control the reckless and indiscriminate use of pesticides.

References

Aminuddin, M., Malek, M. A. , Alamgir Z. Chowdhury and Rahman, M. S. 2004. Studies on organochlorine pesticide residues in water environment of the Dhaka Metropolitan City Area. Nuclear Science and Applications **13**(1, 2): 131-135.

Bagchi S A.K. Azad, M.Alamgir Z. Chowdhury, M. Amin Uddin, Sharif M. Al-Reza and Atiqur Rahman. 2008. Quantitative Analysis of Pesticide Residues in some Pond water samples of Bangladesh. *Asian Journal of Water, Environment and Pollution* **6** (4): pp. 27-30.

Chowdhury, M. A. Z., Amin Uddin M., Malek, M.A. and Zaman M.A. 2010. DDT. Residue and its metabolites in dried fishes of Dhaka city markets. *J. Soil & Environment.* **29** (2): 117-121.

DFG Manual of Pesticide Residue Analysis. 1987. Pesticide Commission, Weinheim, New York, NY: VCH. **1**: 297-307.

Fatta, D., St. Canna-Michaelidou, Michael, C. and E. Demetriou Georgiou. 2007. Organochlorine and organophosphoric insecticides, herbicides and heavy metals residue in industrial wastewaters in Cyprus. *J. Hazardous Materials* **145:** 169-179.

National Pesticide Information Center, 1998. Cypermethrin (Factsheet No. 1.800.858.7378, pp. 1-3). Oregon State Univ. and US Environ. Protection Agency.

Rahman M., Pesticides and Environmental Pollution: Mitigation approach and measures, 2007. T.M.: Support of the facilitating the development and spread of the IPM collaborative research support program, BARC, Dhaka, : pp. 4-12.

Thapar, S., Bhushan, r., & Mathur, R.P. 1995. Degradation of organophosphprus carbamate pesticides in soils: HPLC determination. *Biomed. Chromatography* **9**(1): 18-22.

WHO (World Health Organization). 2003. Carbofuran in drinking water background document for preparation of WHO guidelines for drinking water quality, Geneva, Switzerland.

WHO. 1993. Guidelines for drinking water quality **2**(2): 940-949.

WHO. 2004. *Children are facing high risks from pesticide poisoning - Better protection and awareness rising needed say WHO/FAO/UNEP in a joint note.* In the First Ministerial Conference of the Rotterdam Convention, ended Friday, September 24, 2004. Retrieved November 01, 2010, from http://www.searo. who.int/en/Section23/Section1 326_7472.htm.

(Manuscript received on 05 May, 2012; revised on 30 June 2012)