

PESTICIDE RESIDUE ANALYSIS IN POND AND CANAL WATER SAMPLES FROM THE COASTAL REGION OF BANGLADESH

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The concentrations of pesticides were determined using high performance liquid chromatography (HPLC) of 15 pond water and 10 canal water samples around the paddy or vegetable fields from Sadar Upazila, Lakshmipur (Coastal area). The analysis showed that some water samples were contaminated with organophosphorus and carbamate pesticides. The residue level of diazinon ranged from 0.315 to 0.441 µg/l whereas the carbaryl ranged from 0.136 to 0.204 µg/l. The level of carbofuran was found in the range of 0.373 to 2.208 µg/l, which were above the maximum acceptable levels of total and individual pesticide contamination.

Bangladesh is predominantly an agricultural country with an area of 1,47,570 km² (Hossain *et al.* 2015). Paddy production in Bangladesh has developed from a main occupational activity carried out by the farmer. One of the biggest problems confronting paddy farmers in Bangladesh is diseases and pests which ravage their crops. Paddy generally attracts a wide range of pests and diseases and requires intensive pest management (Dinham 2003). The pest control practices in paddy production in Bangladesh involve mainly the applications of highly toxic pesticides. Pesticides have contributed significantly to improve yields of crops, increasing the production of food grains. So, the use of pesticide is now an inherent part of agriculture for pest control (Bagchi *et al.* 2008). But the practice of indiscriminate use of insecticides leads to build up of pesticide residues in the product, destruction of beneficial insects, pest resurgence, pesticide exposure to farm workers that cause various types of cancer and environmental pollution (Rashid *et al.* 2015). The World Health Organization (WHO 2001) estimated that there are 3 million cases of pesticide poisoning each year and up to 2,20,000 deaths, primarily in developing countries. Hence, water should be free from pesticides, as presumably all populations worldwide are exposed to pesticides (Fardous *et al.* 2015). The aim of this study was to investigate the levels of pesticides in different pond and canal water samples in Sadar Upazila, Lakshmipur district, Bangladesh as well as to

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compare the results of this study with WHO's guideline values. This study also suggests some recommendations to protect pesticide contamination in pond and canal water near paddy and vegetable fields.

Twenty five water samples (15 pond water and 10 canal water samples) were collected from Sadar Upazila of Lakshmipur district near the coastal area (Fig. 1). After collecting the samples, they were preserved in a deep fridge (-20°C) for avoiding loss of the pesticide residues. Water samples (500 ml) were placed in a separating funnel. Fifty gm of NaCl was added to each funnel and shaken with 150 ml of mixed solvent (Hexane: dichloromethane = 1 : 1) for 10 minutes and allowed to settle for 15 minutes. The upper organic layer was collected and the lower aqueous layer was washed two times with 75 ml of the solvent mixture at each wash. Ten gm of anhydrous Na_2SO_4 was added to the three combined organic layers, it was allowed to settle and the decanted organic solvent was then evaporated by rotary vacuum evaporator to dryness. Finally, 1 ml acetonitrile was added prior to the volume of dried extract to inject into HPLC. The spike recoveries



Fig. 1. Map of Sadar Upazila from where samples were taken collected place.

were observed in the range of 76 - 99% for pesticides. Injections of the aliquots were done by micro syringe into HPLC. Tentative identification of the suspected pesticides was carried out in relation to the retention time (RT) of the pure analytical standards. Quantification was made with a freshly prepared standard curve of the relevant (standard) pesticide. Analysis was done by HPLC fitted with Photo Diode Array (PDA) detector.

The results indicated that contamination of water with organophosphate and carbamate pesticides have been found in both pond and canal water (Tables 1 and 2). The carbofuran contaminated pond water samples were from the mosque pond of Lakshmipur Sadar market (WSP2 : 1.792 µg/l), Monir Uddin Pathwarybari pond (WSP3: 0.905 µg/l), Miahbari pond (WSP9: 2.082 µg/l), Torabgonj Borobari pond (WSP13 : 2.208 µg/l), Torabgonj bazaar pond (WSP14 : 0.994 µg/l) and canal water samples were from WAPDA canal west point (WSC2 : 0.373 µg/l) and Rahmat Khali canal near Meghna river (WSC6 : 1.267 µg/l). Carbaryl was identified in two water samples, the highest concentration was from Torabgonj Borobari pond (WSP13: 0.204 µg/l) and the

Table 1. Amount of carbamate and organophosphorous residues in pond water samples of Sadar Upazila, Lakshmipur.

Sample No.	Carbamate pesticide residues (µg/l)		Organophosphorus pesticide residues (µg/l)	
	Carbofuran	Carbaryl	Diazinon	Malathion
WSP1	BDL	BDL	BDL	BDL
WSP2	1.792	"	"	"
WSP3	0.905	"	0.361	"
WSP4	BDL	"	BDL	"
WSP5	"	"	"	"
WSP6	"	"	"	"
WSP7	"	"	"	"
WSP8	"	"	"	"
WSP9	2.082	"	0.431	"
WSP10	2.082	"	BDL	"
WSP11	BDL	"	"	"
WSP12	"	"	"	"
WSP13	2.208	0.204	0.441	"
WSP14	0.994	BDL	BDL	"
WSP15	BDL	"	"	"

WSP = Water sample of pond, BDL = Below detection limit.

lowest concentration was from WAPDA canal near Lakshmipur bus terminal (WSC5: 0.136 µg/l). Field studies have indicated a half-life of 26 to 110 days in soil. Carbamate pesticides are degraded in water by hydrolysis, microbial decomposition, and photolysis (WHO 2003 and Thapar *et al.* 1995). Among the organophosphate pesticides, diazinon and malathion were analyzed. Malathion was not detected in any of the water samples during the present investigation. The diazinon contaminated pond water samples were Monir Uddin Pathwarybari pond (WSP3 : 0.361 µg/l), Miahbari pond (WSP9: 0.431

µg/l), Torabgonj Borobari pond (WSP13 : 0.441 µg/l) and canal water samples were WAPDA canal north point (WSC4 : 0.315 µg/l).

Table 2. Amount of carbamate and organophosphorous residues in canal water samples of Sadar Upazila, Lakshmpur.

Sample No.	Carbamate pesticide residues (µg/l)		Organophosphorus pesticide residues (µg/l)	
	Carbofuran	Carbaryl	Diazinon	Malathion
WSC1	BDL	BDL	BDL	"
WSC2	0.373	"	"	"
WSC3	BDL	"	"	"
WSC4	"	"	0.315	"
WSC5	"	0.136	BDL	"
WSC6	1.267	BDL	"	"
WSC7	BDL	"	"	"
WSC8	"	"	"	"
WSC9	"	"	"	"
WSC10	"	"	"	"

WSC = Water sample of canal, BDL = Below detection limit.

The organophosphate pesticides have limited persistence and degrade fairly rapidly in soil (Shahgholi and Ahangar 2014). The results suggested that the frequent high concentrations (over guideline values) of pesticide residues detected in some selected pond water and canal water are probably due to the extensive utilization of pesticides in nearby paddy fields. Constant drainage of paddy fields and limited knowledge of appropriate ways of administering pesticides are the main influencing factors to transport pesticides into the pond and canal water phase. This contamination poses a threat to human health as they use it for drinking purpose.

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