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**Research Article**

# Detection of Organochlorine and Organophosphorus Pesticides Residues in Water Samples of Taragong Thana in Rangpur District in Bangladesh

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**Abstract:** This study was undertaken to identify Organochlorine and Organophosphorous pesticides residues in water samples of some paddy fields, ponds and tubewells in Rangpur district (Taragong Thana) of Bangladesh by using High Performance Liquid Chromatography (HPLC). Among thirty samples, Organophosphorus (Malathion) pesticide was found in twelve samples while Organocholorine was absent. The level of the pesticide residues (Malathion) were found in the range of 2 to 221 ppm, which were above the maximum acceptable levels of total and individual pesticide contamination.

Keywords: Chloropyrifos, DDT, diazinon, HPLC, malathion

## INTRODUCTION

In Bangladesh there is a rapid increase in the use of pesticides and chemical fertilizers for the growth of newly introduced high yielding variety crops (HYVC). Pesticide was first introduced in Bangladesh in 1951. About 2 tons of pesticides were imported in 1956-57 and the quantity was raised to about 8.000 metric ton in 1993 (ESCAP, 1987). At present about 4 dozens of insecticides with over 150 trade names have been registered in Bangladesh According to a recent government survey, pesticide-related poisonings account for 8% of deaths in Bangladesh for people aged 15-49. 39 Insecticides are being used in Bangladesh in agricultural and public health sector (Satter, 1985).

The use of pesticides has been increased 400 (nil) er acre and its cost increased 600 139323592 during the last couple of decades. Between 1985 and 1990 the sales of pesticides became double. At present, 84 pesticides active ingredients belonging to 242 trade names have been registered in Bangladesh. Out of the total pesticides use, over 80 pesticides used in rice fields. The rapid increase of pesticides use is causing detrimental effect on environment and health of farm workers and consumers.

Pesticides are contaminating ground and surface water, which is causing depletion of inland fishing resources and ecosystem. Chemical pesticides cause widespread environmental problems and are the only toxic chemical deliberately introduced into the environment. Some problems include insect resistance, water pollution, destruction of non-target animals, soil degradation, ozone depletion and localized pollution (Cooley, 1995; Dinham, 1993; Reuveni, 1995). Over-use of pesticides creates insect resistance, destruction of natural enemies and a resurgence of pest species leading in turn to increased spaying, which is also known as “the pesticide treadmill” (Dinham, 1993). It has been estimated that pesticides use could be reduced by thirty-five to fifty percent in the United States without lowering crop yields or causing an increase in the price of food (Reuveni, 1995).

Taragong Thana of Rangpur district is famous for rice and tobacco production. However, crops like wheat, potato and various vegetables are also cultivated in this area. Consequently, pesticides have been used legally or illegally in considerable quantities at Taragong for various purposes. But presently information is not available about the level of pesticide residues in the different water samples (e.g., Paddy field water, lake water, pond water, deep tubewell water) of Taragong. Moreover, there are no substantial works have yet been done for the determination of pesticides levels at Taragong in order to investigate their harmful effects as a result of the random use of pesticides in various application fields. Therefore, Taragong Thana of Rangpur district has undertaken as the study area to carry out.

This research was done to evaluate the level of farmers' pesticides use practiced to rice pest control, their types in the environmental water samples and to propose a sound recommendation to minimize the pesticide pollution in the water of Taragong.

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## MATERIALS AND METHODS

**Study sites:** Rangpur is one of the major cities in Bangladesh. Rangpur Division is proclaimed as Bangladesh's seventh division. It is created with greater Rangur and Dinajpur regions and consists of eight districts which are Rangpur, Lalmonirhat, Kurigram, Gaibandha, Nilphamari, Dinajpur, Ponchigor and Thakurgaon. Taragonj is located at 25.8111°N 89.0167°E (Fig. 1).

It has 21234 units of household. Taragong Thana (Nilphamari district) with an area of 128.68 $km^2$ is bounded by BADARGANJ upazila on the south, RANGPUR SADAR upazila on the east, SAIDPUR upazila on the west. Main rivers are Jamuneshwari and Bullai; noted depressions are Pater Pukur, Hatkhopa, Binnakuri, Sayar and Charliar beels. Taraganj has 5 Unions/Wards, 40 Mauzas/Mahallas and 41 villages. Unions are: 1. Alampur 2. Kursha 3. Ekarchali 4. Hariarkuti and 5. Soyar. The samples collections from the following unions (Table 1):

Table 1: Name of the unions of Taragong thana

| Unions of Targong Thana | Villages |
|---|---|
| 1. Ekarchali | I. Town |
| | II. Matial para |
| 2. Alampur | III. Chaltaira |
| | IV. Chakla |
| 3. Sayar | V. Dorgapar |
| | VI. Faridabad |
| 4. Kursha | VII. Ghonirampur |
| | VIII. Anontopur |
| 5. Hariarkuti | XI. Jummapara |
| | X. Pataipara |

**Water sampling and analysis:** The samples were collected in October 2009, it was Late Autumn season. The experiment comprising the study on the monitoring of pesticides residues in three different sources of tubewell water, pond water and paddy field water from 5 unions of Taragong Thana of Rangpur district in Bangladesh. For this reason, the water samples from respective spots and types were collected and brought to the Agrochemical and Environment Research Division (AERD), Institute of Food and radiation Biology (IFRB), Atomic Energy research Establishment (AERE), Savar, Dhaka. The water samples were processed for subsequent experiments and for necessary analysis. This analysis was conducted with High Performance Liquid Chromatography (HPLC) apparatus according to the method of Matin *et al*. (1998).

For analyzing Organochlorine (Ocs) and Organophosphorus (Ops) pesticides residues, the experimental samples were prepared according to the following procedure as showing in Fig. 2:

The High Performance Liquid Chromatography (Waters Company) equipped with ultra violet (UV) detector manual by micro syringe at 15 µL volume where the mobile phase is Acetonitrile 65%, column $C_{18}$ (Nova Pack) along with the output device at 254 nm absorbance was used for determination of the level of Organophosphorus and Carbamate pesticide residues as data along with dialogues and report i.e., peak area %, retention time and area Basement Count (BC).

Tentative identification of the suspected insecticide was carried out in relation to the retention time (RT) of the pure analytical standard of that insecticide, standard DDT, DDE, DDD for Organochlorines and Diazinon, Malathion, Chloropyrifos for Organophosphorus were purchased from chromo-pack.

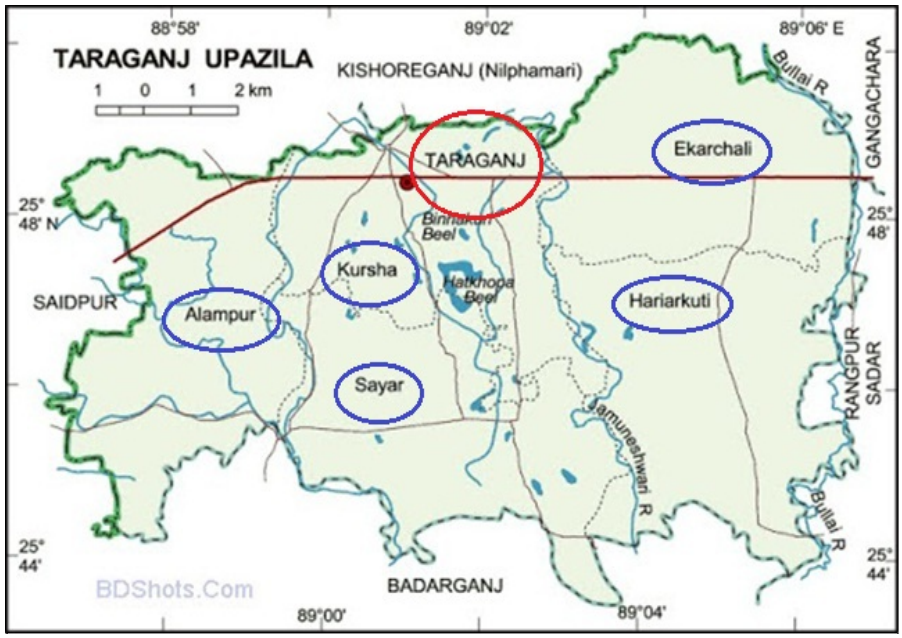


Fig. 1: Taragong Thana

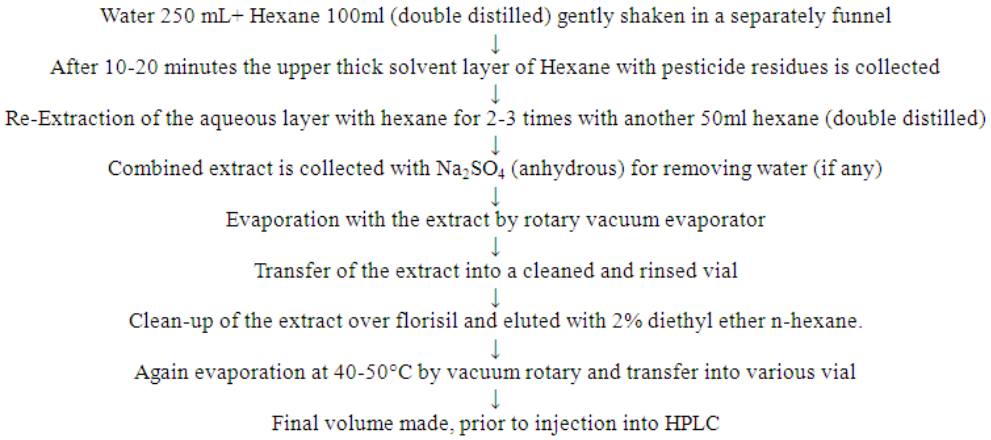


Fig. 2: Flow chart of sample preparation

## RESULT AND DISCUSSION

Test of water samples for Organochlorine (DDT, DDE and DDD) Organophosphorus pesticides were performed by High Performance Liquid Chromatography (HPLC). Results for the presence of different Organochlorine and Organophosphorus pesticides are given in Table 2 and 3.

DDT, DDD, DDE were not found in the water samples collected from Taragong Thana. This result is similar to Anwar (1995). He found no pesticide in the samples collected from Gangachara Thana of Rangpur district which were analyzed at the Institute of Food and Radiation Biology (IFRB) under Atomic Energy Research Establishment (AERE), Savar.

When all the collected water samples were analyzed in the chromatograph, peaks of any water samples tested did not resemble to any of the peaks of the mixed standard chromatogram of Organochlorine pesticides. During the analyses some other small peaks were also observed. It may be due to the presence of unknown contaminants, this contamination may arise from the injection syringe, Vial or any other ways.

Residues from the pesticides leach into the water, which are harmful to anything in the water. A study was done for Lake Ichkeul in the North of Tunisia. This is an important bird sanctuary and a unique ecosystem because it is connected to the sea by a narrow channel and renewal of its waters is rather slow. It also collects

Table 2: Results of organochlorine pesticides residues (ppm) in water samples of Taragong

| Sl No. | Sample No. | DDT | DDE | DDD |
|---|---|---|---|---|
| 1. | 1P | ND | ND | ND |
| 2. | 1d | ND | ND | ND |
| 3. | 1T | ND | ND | ND |
| 4. | 2P | ND | ND | ND |
| 5. | 2d | ND | ND | ND |
| 6. | 2T | ND | ND | ND |
| 7. | 3P | ND | ND | ND |
| 8. | 3d | ND | ND | ND |
| 9. | 3T | ND | ND | ND |
| 10. | 4P | ND | ND | ND |
| 11. | 4d | ND | ND | ND |
| 12. | 4T | ND | ND | ND |
| 13. | 5P | ND | ND | ND |
| 14. | 5d | ND | ND | ND |
| 15. | 5T | ND | ND | ND |
| 16. | 6P | ND | ND | ND |
| 17. | 6d | ND | ND | ND |
| 18. | 7P | ND | ND | ND |
| 19. | 7d | ND | ND | ND |
| 20. | 8P | ND | ND | ND |
| 21. | 8d | ND | ND | ND |
| 22. | 9P | ND | ND | ND |
| 23. | 9d | ND | ND | ND |
| 24. | 10P | ND | ND | ND |
| 25. | 10d | ND | ND | ND |

ND = Not Detected; P = Pond water; D = Ditches water; T = Tube Well water

Table 3: Results of organophosphorus pesticides residues (ppm) in water samples of Taragong

| Sl No. | Sample No. | Malathion | Diazinon | Chloropyrifos |
|---|---|---|---|---|
| 1. | 1P | ND | ND | ND |
| 2. | 1d | ND | ND | ND |
| 3. | 1T | 10 | ND | ND |
| 4. | 2P | 10 | ND | ND |
| 5. | 2d | ND | ND | ND |
| 6. | 2T | 5 | ND | ND |
| 7. | 3P | ND | ND | ND |
| 8. | 3d | ND | ND | ND |
| 9. | 3T | ND | ND | ND |
| 10. | 4P | 10 | ND | ND |
| 11. | 4d | ND | ND | ND |
| 12. | 4T | 56 | ND | ND |
| 13. | 5P | ND | ND | ND |
| 14. | 5d | 1 | ND | ND |
| 15. | 5T | 4 | ND | ND |
| 16. | 6P | ND | ND | ND |
| 17. | 6d | ND | ND | ND |
| 18. | 7P | 64 | ND | ND |
| 19. | 7d | 221 | ND | ND |
| 20. | 8P | ND | ND | ND |
| 21. | 8d | 2 | ND | ND |
| 22. | 9P | 2 | ND | ND |
| 23. | 9d | 59 | ND | ND |
| 24. | 10P | ND | ND | ND |
| 25. | 10d | ND | ND | ND |

ND = Not Detected; P = Pond water; D = Ditches water; T = Tube Well water

water from many small rivers, which cross a densely cultivated area, in which larger amounts of pesticides are used. The study showed after examining the lake sediments and bird's eggs that they contained Organochlorine and PCB residues (Cooley, 1995).

Residues of pesticides have been found in many other bodies of water. Along with this, a pesticide hasn't been found yet to target only the insect we want it to destroy. So, it not only kills pests but some other non-target animals as well. Fish in the waters that are contaminated with pesticide residues often die leading to a decrease in fish yields and losses of traditional fishing grounds. As well, intoxication of fish, birds, cattle and wild animals is common during spraying season. The death of birds and fish due in part to pesticides is most common, which has led to bans of certain pesticides in some places (Stevens, 1994). This makes people wonder if it's even worth using pesticides.

Among Organophosphorus residues the samples were compared with the standard of Malathion, Diazinon and Chloropyrifos pesticides. According to the standard (laboratory based with wavelength 254 nm) the concentration levels of Malathion, Diazinon and Chloropyrifos are 2-4 ppm, 1-4 ppm, 3-6 ppm respectively. Among 25 samples Malathion is found in 12 samples.

Braun and Frank (1980) found that Malathion was present in the range of 0.24 to 1.8 µg/L in only four of 949 stream water samples in 11 southern Ontario agricultural watersheds from 1975 to 1977 (detection limit 0.1 µg/L).

Using a new quality control tool, no pesticide residues, at a level of 0.05 ppm or above, have yet been found in brewing water samples from Denmark or abroad (Kuster *et al*., 2002).

Frank and Logan (1988) also detected Malathion only once (0.99 µg/L) in 446 samples from three Ontario river basins (detection limit 0.1 µg/L).

Malathion is used in wide scale in rice field in Bangladesh. Most of the farmers in Bangladesh applied Malathion at the dose of 3G 1(recommended rate 16.8 kg/ha).5 kg/ha (Rahman and Alam, 1997).

The rate of disappearance of Malathion from soil has been reported to be 75 to 100% in one week (Verschueren, 1983). As the samples were collected during Late Autumn season and it was the season of rice harvesting. Generally pesticides are applied in 1 to 2 month prior to harvesting, so the pesticide residue may degrade that time. Some samples were collected from vegetables fields, where pesticides were used 15-20 days ago. During that period there was no rain to run off the pesticide to nearby water body. As Organophosphorus degrades quickly in between 1-2 weeks (Barcelo *et al*., 1995), so pesticide cannot be identified.

Malathion (C10H19O6PS2) is an organophosphorus insecticide and acaricide used for the control of a variety of insects and mites on a wide range of agricultural and horticultural crops (FAO/WHO, 1977) as well as for the control of mosquitoes, flies, household insects, animal ectoparasites and human head and body lice.

All the data obtained from the experiment were analyzed by using SPSS-10.0. From the analysis no significance different of concentration level of pond, ditches and tubewell was found (ANOVA, LSD, $p<0.05$).

**Concluding remarks:** This research gives a preliminary baseline data of pesticide residue levels in the water samples of Taragong thana of Rangpur district. However, there is evidence to conclude that organochlorine pesticides residues (DDT and its derivatives) were absent in the analyzed water samples. So, farmers of Taragong thana do not use organochlorine as pesticide. But Malathion was used by the farmers as it was found in twelve samples.

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