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Original Article

Determination of Pesticide Residue (Cartap) in Brinjal

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Abstract: Two types of brinjal samples (e.g. untreated and treated) were collected from Chuadanga district of Bangladesh for the purpose of pesticide residue analysis. A dose of 2.5g/L of cartap a.i. pesticide was sprayed at the time of cultivation in the field. High performance liquid chromatography (HPLC) was used to determine residue in the samples. The range of concentrations of cartap in treated samples, (T-1, T-2, T-3, T-4 and T-5) was from 0.954 to 3.300 ppm where cartap levels were found above the Maximum Residue Limit for crops 0.5 ppm recommended by FAO/WHO. The study reveals that use of pesticide to minimize vegetable infestation is increasing and this trend would be detrimental to mankind as well as environment. The regular monitoring of pesticide residue may be made and develop awareness among people and responsible authorities. In addition, future investigations to study the effect of pesticides on nutritional values of fruits and vegetables would be worthy.

Keywords: Cartap, brinjal, pesticide residue, HPLC

1. INTRODUCTION

Bangladesh is an agricultural country with an area of 1, 47,570 sq. km. Agriculture plays an important role in the lives of Bangladeshi people. The major crops grown are rice, wheat, jute, potato, sugarcane, vegetables and tea. [1]. Vegetables are the fresh and edible portion of the herbaceous plants. They are important food and highly beneficial for health. They contain valuable food ingredients, which can be successfully utilized to build up and repair the body [2]. Brinjal (*Solanum melongena* L.), an important vegetable, is available year-round, with the peak season during the months of August and September. Brinjal *is* used as experimental sample in the present research work, a popular and extensively cultivated vegetable in Bangladesh and has a serious insect pest problem in the field. The main pests that attack plants are Brinjal fruit borer, Stem borer, Spider mite,

Aphid, Jassid, Whitefly and Roots-cutworm. [3]. Hence, in order to combat the insect pest problem, lot of pesticides is used by the vegetable growers. For better yield and quality, insecticides are repeatedly applied during the entire period of growth and sometimes even at the fruiting stage. It accounts for 13-14 percent of total pesticides consumption, as against 2.6 percent of cropped area [4]. Indiscriminate use of pesticides particularly at fruiting stage and non adoption of safe waiting period leads to accumulation of pesticide residues in vegetables. Contamination of vegetables with pesticide residues has been reported by several researchers [5-7]. Dittus, e*t al.* (1993) stated that various statistics regarding pesticide residue in vegetables has grown an increasing fear about health hazards. Multiple regression analysis indicated that 41% of residue reducing behavior and 44% of health concerns about pesticides were explained. Individuals with health concerns had high scores for residue reducing behavior, environmental concerns and perceived susceptibility to cancer [8].

Very few studies in this area have been performed in Bangladesh but no specific record has been noticed. Therefore, the present study has been undertaken to analyze the concentration

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of cartap residue present in brinjal with compared to maximum residue limit (MRL) by FAO/WHO and to create awareness of pesticide residue infestation in future.

2. MATERIALS AND METHODS

2.1. Chemical/Reagents

Cartap standard was purchased were purchased from Dr. Ehrenstorfer GmbH, D-86199 Augsburg, Germany.Organic solvents (hexane, dichloromethane, acetone, diethyl ether and ethyl acetate) of analytical grade, Anhydrous sodium sulfate (Na_2SO_4), Aluminum oxide (Al_2O_3), Nitric acid (HNO_3), Silver nitrate ($AgNO_3$), Florisil (60-100 mesh size) and Silica gel were purchased from local market.

2.2. Sample Collection and Storage

The brinjal (*Solanum melogena*) used in this study was procured from local area of Chudanga, a district of western region of Bangladesh. Both samples of brinjal plant was grown and collected from the same soil and environment but treated samples were grown using cartap pesticide sprayed at the selected interval and dose of 2.5g/L. Samples were collected in airtight polythene bag with tagging each sample and were brought to the Laboratory named Agrochemical and Environmental Research Division (AERD) at Institute of Food and Radiation Biology (IFRB), Atomic Energy Research Establishment (AERE) as early as possible and stored at -20 ^oC [9-10] .

2.3. Extraction

Fifty gram of each sample was sliced on chopping board. The sliced samples were taken into a 250 ml conical flask and added 125 ml double distilled hexane. The mixture was shaken with orbital shaker at 200 rpm for 1 hour. The extract was evaporated to 1 to 2 ml with rotary vacuum evaporator at 40°C.

2.4. Clean up

Florisil column chromatography was used to clean up the extract [11]. The florisil, synthetic magnesium silicate, (Mesh size 60-100) was activated at 200°C for 6 hours and deactivated with 2% distilled water. The top 1.5 cm of the florisil column was packed with anhydrous sodium sulphate. Elution was done with a solvent mixture of 2 % diethyl ether in hexane at 5ml/min. The elute was concentrated in a rotary evaporator and transferred to a vial. Solvents were evaporated under nitrogen flow. The dried sample was re-dissolved in acetonitrile (1ml) for subsequent analysis by high performance liquid chromatography (HPLC) [12].

2.5. Analysis

After cleaned up, the aliquots of the final volume were quantified by High Performance Liquid Chromatography (Shimadzu) LC-10 ADvp) equipped with a SPD-M 10 Avp, PDA detector; C18 Reverse Phase Alltech analytical column (250 x 4.6 mm). The cleaned-up vegetable extracts, prior to analyses by HPLC, were passed through 0.45 µm nylon (Altech Assoc) syringe filters. The details of High Performance Liquid Chromatographic analytical conditions are given in table 1. Tentative identification of the suspected pesticide was carried out in relation to the retention time of the pure analytical standard. Quantification was made with respect to peak area of freshly prepared standard curve of the relevant standard pesticide.

Table 1. Operating conditions of high performance liquid chromatography.

Apparatus	SHIMADZU, Japan
Detector	Photo Diode Array Detector (PDA)
Injector	Manual by Micro-syringe
Injection volume	20 µl
Mobile phase	65% Acetonitrile in water
Column	C_{18} (Nova Pack)
Oven temperature	30^0C
Flow rate	1.0 ml/ min
Absorbance	200-800 nm

RESULTS AND DISCUSSION

Pesticides are widely used for protection of crop, preservation of food, public health purposes, and to control the insect pest of plants. By nature pesticides are toxic material which acts on insect and pest. The indiscriminate and overuse of pesticides create many problems, such as, excessive residues on the fruits that affect the health of the consumers and the environment, pesticide resistance, poisoning, hazard to non-target organism especially parasitoids and predators, rise in production cost etc. [13-14].

Standard chromatogram for cartap analysis is given in figure. 1. Tests result for sample T-2 is shown in the figure. 2., only cartap pesticide was detected in the investigation. The result of the pesticide residue analysis of brinjal samples is represented in table 2. The peak area and height of the treated samples were observed but the control samples did not show any peak. The peak area of treated sample T-1 to T-5 was 25772, 27870, 65247, 80328 and 89137 mm^2 respectively while the area of control C-1 to C-5 was not recognized. The pesticide concentrations of samples T-1 to T-5 were 0.954, 1.032, 2.416, 2.974, and 3.300 mg per kg (ppm) respectively.

Bai *et al.* (2006) determined the concentrations of eight organophosphorous pesticides in 18 of 200 samples. Five organophosphorous pesticides, including dichlorvos, dimethoate, parathion-methyl, pirimiphos-methyl and parathion were found in concentrations ranging from 0.004 to 0.257 mg/kg. Present study showed that residue of cartap was present in the treated samples. [15].

In our study the residue limit was 0.954 to 3.300 mg per kilogram. It is seen from the standard chromatogram that cartap can be detected before retention time of 7.861 minutes. Comparing the test results with the standard chromatogram it was found that treated sample contained lowest concentration 0.954 mg /kg in sample No.T-1 and highest concentration 3.300 mg / kg in treated sample No. T-5.

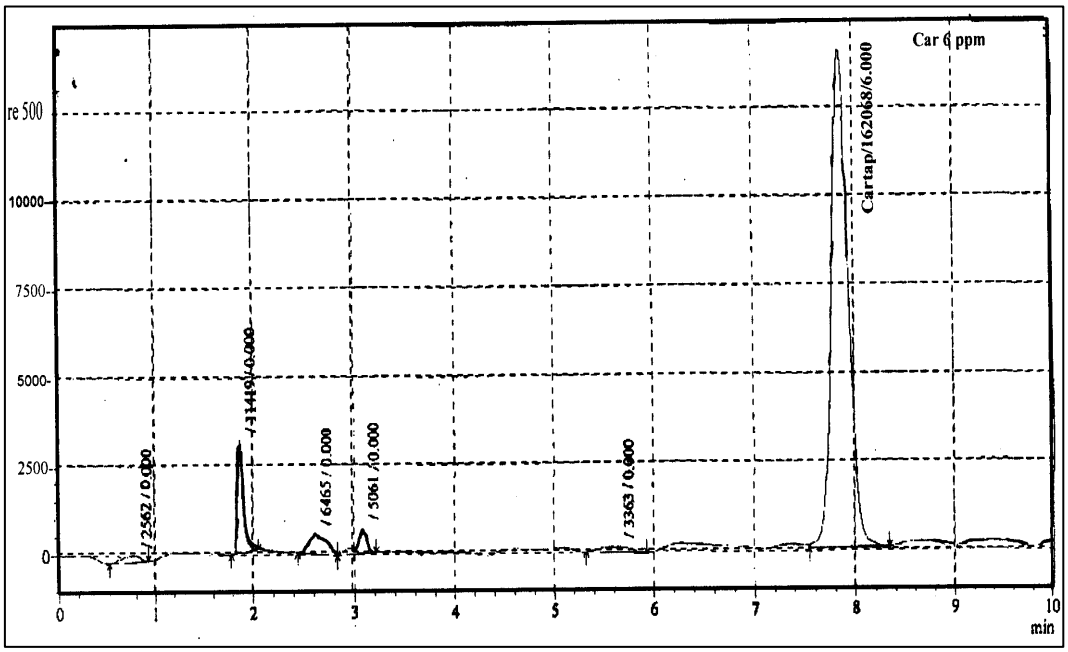

Fig. 1. Standard chromatogram of cartap pesticide at 6 mg/kg.

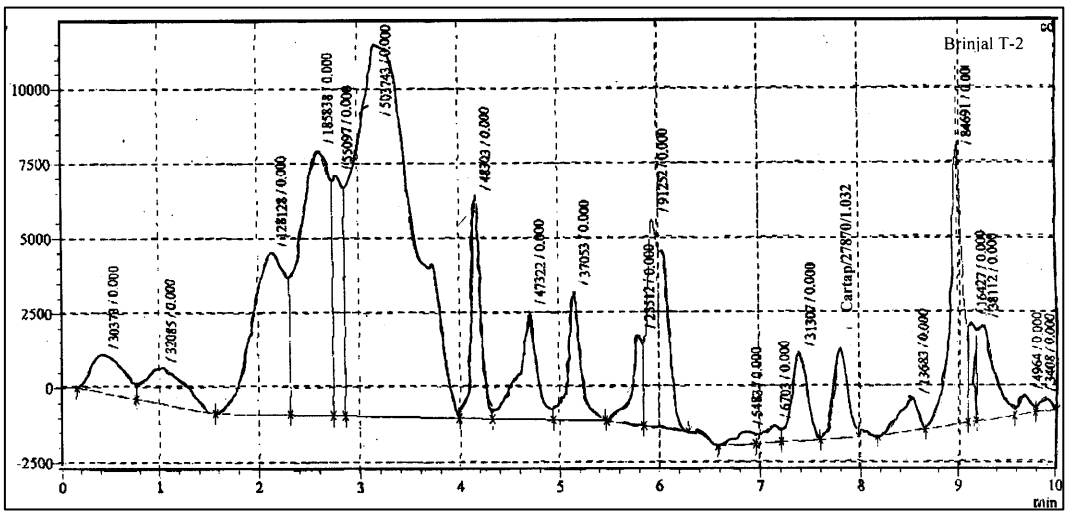

Fig. 2. Chromatogram of treated brinjal sample no. 2 (T 2) showing presence of cartap pesticide.

Table 2. HPLC analysis report of brinjal sample and standard cartap pesticide.

Sample	Sample ID	Ret. time (min)	Peak area (mm^2)	Peak height (mm)	Concentration (mg/ kg)
Brinjal	[1]T-1	7.744	25772	2979	0.954
	T-2	7.802	27870	2990	1.032
	T-3	7.787	65247	6910	2.416
	T-4	7.789	80328	7845	2.974
	T-5	7.85	89137	9758	3.300
	[2]C-1	0.00	0000	0000	0.00
	C-2	0.00	0000	0000	0.00
	C-3	0.00	0000	0000	0.00
	C-4	0.00	0000	0000	0.00
	C-5	0.00	0000	0000	0.00
	std. 6ppm	7.861	162068	14025	6.00

[1]T Treated sample; [2]Control sample

Table 2. shows concentration of pesticide in parts per million of 10 brinjal samples as 5 treated and 5 control samples. It also shows that the standard cartap pesticide's concentration (ppm), retention time, peak area and height of peak for chromatogram. The retention time, peak area, and height was 7.861 minute, 162068 mm^2 and 14025 mm^2 respectively of the standard cartap pesticide. The retention time of treated sample T-1, T-2, T-3, T-4 and T-5 was 7.744, 7.802, 7.787, 7.789 and 7.85 minute respectively whereas the retention time of control sample C-1, C-2, C-3, C-4 and C-5 was not shown. The residue limit was found to be 0.954 to 3.300 mg per kg of vegetable. Mousa *et al.* (2004) recorded the phorate pesticide residue on the egg plant fruits on 45, 46, 48, 52,and 59 days after soil application were 0.051,0.042, 0.031, 0.014 and 0.008 ppm in case of the recommended dose (1.0 Kg a.i./ha) respectively[16]. Similar results were found of the captan residues in fruits in Canada [17]. Caboni *et al.* (2006) stated that the maximum limit of pesticides residue concentration in fruits and vegetable range from 0.01 to 0.5 mg/kg. The results obtained ware compared with that of Caboni *et al.* (2006) in the range 0.954 to 3.300 mg /kg and found exceeded the maximum residue limit for crops (0.5 mg / kg) recommended by FAO/WHO (1996) [18-19].

CONCLUSION

The observed range of pesticide concentration was 0.954 to 3.300 mg per kg. All the samples were found exceeded the standard residue level. The food with such concentration of pesticide residue cause toxicity for human being and living organism. The most serious concern regarding the pesticide use is its hazardous effects on different components of the environment includes fish, birds, beneficial insects, wildlife, and human being. The pesticide residue cause disease and illness such as carcinogenesis, teratogenesis, mutagenesis, cancer, learning disabilities, enzyme inhibitor, reproductive toxicity, skin disease and various problems created of living being. The findings of the present research suggest that a restricted and controlled use of such persistent pesticides is useful to decrease the contamination level in different food items. This study may be helpful for public awareness, a guideline to government for pest control management in case of fruit and vegetable production and maintenance of nutritional requirements of population.

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