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Assessment of some home processes for decontamination of insecticide residues in vegetables

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ABSTRACT

The present investigation was conducted at "Residue Analysis Laboratory" Department of Entomology, College of Agriculture, Raipur (C.G.) during 2009-2010 on Assessment of insecticide residues in vegetables. The indiscriminate use of pesticide on vegetables possesses serious residue problems in humans, animals and environment. The residue is above the Maximum Residue Limit values. Contamination may occur mainly due to harvest of crops before the recommended waiting period. The household processing is the preparation of food using like washing, peeling, cooking, trimming or hulling is reduce to some extent of toxicity from food material. This present results revealed that out of different home processing procedures, tap water wash for 15 minutes was found to be the best for decontamination of endosulfan residues on tomato to an extent of 89.59 per cent followed by hot water treatment (84.24 %).

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INTRODUCTION

The extensive and indiscriminate use of pesticide on vegetables possesses serious residue problems, which are hazardous for human and animal health, natural enemies and the environment. The 96 samples of 10 different vegetables, 67 per cent were contaminated with over 10 kinds of insecticide residues. In 7 per cent samples of the vegetables (cauliflower, brinjal, cabbage and tomato), the residue were above the Maximum Residue Limit (MRL) values (Chahal, 1997). It has been estimated that on an average Indian ingested about 40 times more pesticide residues with food and water than the average Westerner (Gupta, 2006). A survey conducted in U.P. and Hyderabad revealed that the average pesticide intake through food on an average were 0.27 and 0.36 mg/person/day, respectively (Anonymous, 2004).The use of endosulfan, cypermethrin, dimethoate, monocrotophos and mancozeb was more frequent than other pesticides and observed detectable residue in tomato (33.3 %), brinjal (73.3 %) and okra (14.3 %) (Dathe *et al.*, 1995). The household or commercial food processing is the preparation of food

using various processes, such as washing, peeling, cooking, trimming or hulling were reduced to some extent of toxicity from food material (Nagesh and Verma, 1997). The removal of endosulfan residues on tomato fruits by three processing methods, carried out by dipping tomato fruits in 2 per cent tamarind solution for 5 minutes followed by tap water wash was found to be the best for decontaminating the residues to an extent of 43.8 and 58.6 per cent at recommended 0.07 per cent and high doses 0.14 per cent of endosulfan, on zero day after application as against 30.3 and 44.1 per cent with dipping in 2 per cent salt solution for five minutes followed by tap water wash (Gopicahnd *et al*., 1999). Surveys conducted in India have indicated that 50-70 per cent of vegetables are contaminated with the insecticide residues probably due to their use in the fields. Contamination may occur mainly due to harvest of crops before the recommended waiting period. In general, pesticide analysis are performed in raw agricultural commodity, which including the peel and other non- edible parts. However, cabbages are subjected to some form of household preparations, e.g. washing, cooking, removal of non-edible parts etc. before actual consumption. The effects of these processing techniques on residue level are extremely important in evaluating the risk associated with ingestion of pesticides residues (Aktar *et al*., 2009). Therefore, the present investigation was carried out to examine on effect of washing with different solutions on endosulfan residues in tomato fruits.

MATERIAL AND METHODS

The investigation entitled "Assessment of some home processes for decontamination of insecticide residues in vegetables" was conducted during 2009-2010. The laboratory studies were conducted at "Residue Analysis Laboratory" Department of Entomology, College of Agriculture, Raipur (C.G.).

Decontamination study:

Collection of sample :

Representative tomato fruit sample of marketable size were collected from the endosulfan @ 0.07 per cent treated plots at one day after spraying followed by different home processing procedures were applied for removing of residue. The insecticide residue present in the tomato sample was estimated as per the technique adopted by Agnihotri (1999). However, these steps adopted (or) being reproduced here under.

Decontamination procedures :

The following procedure was adopted for decontamination studies.

Step 1 - Tap water was for 15 minutes.

Step 2 - Dipping the tomato fruits in 2 per cent tamarind solution for 15 minutes followed by tap water wash.

Step 3 - Dipping the tomato fruits in 2 per cent salt solution for 15 minutes followed by tap water wash.

Step 4 - Dipping the tomato fruits in 1 per cent solution of vinegar in water for 15 minutes followed by tap water wash.

Step 5 - Dipping the tomato fruits in 0.05 per cent solution of $NaHCO_3$ solution in water followed by tap water wash.

Step 6 - Dipping the tomato fruits in 0.1 per cent suspension of turmeric powder in water followed by tap water wash.

Step 7 - Dipping the tomato fruits in hot water treatment for 15 minutes.

Step 8 - Untreated sample.

Protocol for estimation of endosulfan :

Extraction :

Treated through different home processed tomato (500 g) were chopped with a sharp knife or a chopping board and mixed thoroughly. The sample was thoroughly blended to obtain a homogeneous representative sample for weighing. 20 g samples was taken in a mortar and pestle and macerate it with 4-5 g anhydrous sodium sulphate then add 100 ml acetone and extract by shaking on mechanical shaker for 1hour. After one hour filter the extract through 2-3 cm layer of anhydrous sodium sulphate. Concentrate the extract to 40 ml on rotary flash evaporator after adding a drop of mineral oil and dilute the extract 4-5 times with 10 per cent NaCl aqueous solution.

Partition it thrice with ethyl acetate (50 and 30 ml) in a separatory funnel by shaking vigorously for 1 minute, combine the organic (ethyl acetate) phases and filter through anhydrous sodium sulphate, concentrate the organic phase upto 5 ml on rotary flash evaporator and concentrated extract for organochlorine.

Clean up :

Glass wool was placed at the bottom of chromatographic column fitted with draw-off valve and was used for the clean up and pack the glass column (60 cm x 22 mm i.d) with adsorbent mixture (5 g) Florisil: activated charcoal (5:1 w/w) in between two layer of anhydrous sodium sulphate and tap the column gently to ensure uniform and compact packing, prewett the column with 50 ml hexane and transfer the concentrated extract to the column and elute the column with 125 ml solution of ethyl acetate: hexane (3:7 v/v), concentrate the elute to near dryness using rotary flash evaporator followed by gas manifold evaporator after adding one drop of mineral oil and make the final volume to 2 ml in ethyl acetate: n hexane (3:7 v/v) and then analysed using chromatographic techniques.

Analytical techniques used for pesticide residue analyses :

The chromatographic techniques, *i.e.*, gas chromatograph and mass spectrometer (GCMS QP 2010) were used for the determination pesticide residues in vegetable samples in the present study.

Gas chromatograph and mass spectrometer (GC-MS) :

The multidimensional system of GC-MS is a powerful tool for the qualitative and quantitative analysis of mixtures of complex volatile pesticide compounds because of the separating abilities of GC and structure identification abilities of Mass and Com. It has been widely employed for pesticide residue monitoring studies because of its high sensitivity and specificity, as well for its potential of multiresidue and multi-class analysis.

Chromatograph for endosulfan :

One micro liter (1 µl) of this solution was injected in the injection port and computer programme was executed simultaneously. The identifiable peak and retention time were recorded.

Interpretation of residues data :

The following formula was used to derive the residues level in test sample:

$$\text{Residue (ppm)} = \frac{\text{Area of sample}}{\text{Area of standard}} \times \frac{\mu\text{l of sample injected}}{\mu\text{l of standard}} \times \frac{\text{Final volume}}{\text{Weight of sample}}$$

RESULTS AND DISCUSSION

The data on effect of washing with different solutions on endosulfan residues in tomato (Table 1) indicated that the untreated sample contained endosulfan residues. Out of seven processing procedures for the removal of endosulfan residues on tomato fruits, the treatment one (T_1) *i.e.* tap water wash for 15 minutes was found to be the best for decontaminating the residues to an extent of 89.59 per cent at recommended doses of endosulfan. The second best treatment was found T_7 *i.e.* hot water treatment/ cooking for 15 minutes which recorded decontamination to an extent of 84.24 per cent.

Dipping the tomato fruits in 2 per cent tamarind solution (T_2) for 15 minutes was found to be the least for decontaminating the residues to an extent of 41.50 per cent. A study alkaline solution with 0.05 per cent $NaHCO_3$ removed 71.26 per cent endosulfan residues than a slightly acidic solution with vinegar (60.45%). The order of effectiveness in removing endosulfan residues are as follows: Tap water > cooking > $NaHCO_3$ > Vinegar > Salt > Turmeric powder > Tamarind. Similar findings were reported by Singh and Kapoor (1998) that, the washing treatment was given to one day pesticide treated fruit, the reduction in residues was found to be about 85 per cent. Tejeda *et al.* (1995) that, there was a

Table 1: Decontamination of endosulfan (0.07%) residues in/on tomato (one day after spray)

Tr. No.	Processing procedures (upto 15 minutes)	Residues (ppm)	Per cent detoxification
T_1	Tap water wash	0.101	89.59
T_2	2% tamarind solution in water	0.569	41.50
T_3	2% salt solution in water	0.413	57.46
T_4	1% solution of vinegar in water	0.384	60.45
T_5	0.05% solution of $NaHCO_3$ in water	0.279	71.26
T_6	0.1% suspension of turmeric powder in water	0.556	42.73
T_7	Hot water/cooking	0.153	84.24
T_8	Untreated	0.971	

100 per cent reduction with tap water and cooking in vegetables. Reddy *et al*. (2001) reported that the initial residues of triazophos can be removed to an extent of 64 to 68 per cent by washing with water and steam cooking and in 5 day samples residues can be removed upto 41 to 56 per cent on brinjal. Reddy *et al*. (2003) observed that the grape berries can be harvested and consumed one day after spraying. Secondly dipping of grape berries in 2 per cent salt solution for 30 minutes followed by washing removed the residues of carbaryl and isoprocarb one day after eighteenth spray upto an extent of 99 per cent. Kumari (2008) determined a study on residue levels of three vegetables *viz.*, brinjal, cauliflower and okra to know the residue levels and evaluated the effect of different household processes (washing and boiling/cooking) on reduction of residues. In the three vegetables *viz*., brinjal, cauliflower and okra washing reduced the residues by 20-77 per cent and boiling by 32-100 per cent. Aktar *et al*. (2009) reported that residue of Chlorpyriphos in Cabbage heads in the range of 27.89-73.32 per cent but none were able to satisfactorily bring down the residue below the tolerance level of 0.05 mg kg^{-1}. A minimum of about twelve days was suggested as safe waiting period. Deen *et al*. (2009) studied that the half- life periods calculated were 3.3, 5.2 and 3.8 days and safe waiting periods were 4.7, 8.6 and 8.3 days for cypermethrin, λ-cyhalothrin and endosulfan, respectively. Residue level reached below MRL (Maximum Residual Limit) value of each pesticide in 9 days. Washing reduced the maximum residues of cypermethrin, λ-cyhalothrin and endosulfan upto 37.4, 35.6 and 23.8 per cent, respectively.

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