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DECONTAMINATION OF BIFENTHRIN AND PROFENOFOS RESIDUES IN EDIBLE PORTION OF BITTER GOURD (*Momordica charantia*), THROUGH HOUSEHOLD TRADITIONAL PROCESSING

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Abstract- The study was conducted to assess the effect of household processing methods such as washing, sun drying, cooking/ frying and blanching on the decontamination of bifenthrin and profenofos residues in experimentally grown bitter gourd. Simple washing of bitter gourd with tap water reduced the residues of bifenthrin to 50.62% and that of profenofos to 53.66%. Subsequent washing with detergent solution indicated a reduction of 59.78 and 65.85% in bifenthrin and profenofos residues respectively in the bitter gourd. Blanching as a processing tool has exerted a more protective effect with a drop of 80.71% in bifenthrin and 78.05% profenofos residues. A significant decrease in bifenthrin (89.65 %) and profenofos (87.92%) residues was also observed by plain washing followed by sun drying. Frying appeared to be the most effective technique to minimize bifenthrin and profenofos residues to the extent of 93.41% and 88.68%, respectively, suggesting that frying is the most potent protective food processing approach to curtail bifenthrin and profenofos in bitter gourd.

Keywords- Bifenthrin, bitter gourd, decontamination, pesticides residues, profenofos

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Introduction

Pesticides are used globally for the protection of food, fiber, human health and comfort. Food is the basic necessity of life and food contaminated with toxic pesticides is associated with severe effects on the human health. Hence, it is pertinent to explore strategies that address the situation of food safety especially for the developing countries where pesticide contamination is widespread due to indiscriminate usage. Food scientists have long been interested in the effect of commercial processing on reduction of pesticide residues in food and it has been observed that pesticide residues in plant produce are reduced by processing or some household preparations like washing, peeling, cooking etc. [1]. Good knowledge of the pesticides fate in agriculture is necessary to properly assess human exposure and the environmental impact of these contaminants. Pakistan happens to be the 2nd largest consumer of pesticides among the south Asian countries and 27% of the total pesticides consumed are used on fruits and vegetable crops [2]. Pesticides use, has no doubt led to increased agricultural productivity in general, but persistent residual impact of these chemicals have conspicuously affected the environment as well as human health. According to the United Nations 1998 report, 0.5 million Pakistanis suffered from pesticide poisoning annually due to use of agrochemicals, resulting in 0.1 million deaths [3]. Indiscriminate use of pesticides particularly at fruiting stage and non adoption of safe waiting period leads to accumulation of pesticides residues in consumable vegetables. Since farmers indiscriminately apply a cocktail of insecticides on vegetable crops, the increasing amount of pesticide residues in vegetables has been a major concern to the consumers. Among the pesticides used profenofos [0-4-bromo-2-chlorophenyl- 0-ethyl S-propyi phosphorothio-ate] is a broad spectrum organophosphate insecticide and acaricide widely used to control various insect pests on vegetable crops in Pakistan. Another Bifenthrin, ((2-methyl-1, 1-biphenyl-3-y1)-methyl-3-(2-chloro-3, 3, 3-trifluoro-1-propenyl)-2, 2-dimethyl cyclopropanecarboxylate is an insecticide that has shown good bioefficacy against insect pests of brinjal [4] and tomato [5].

Vegetables, highly beneficial for the maintenance of human health [6] are an essential component of human diet. Besides providing a variety and bulk to the diet, they are good source of vitamins [7]. Among vegetables, bitter gourd (*Momordica charantia*) is a common man's vegetable grown in almost all over Pakistan. Production of bitter gourd in Sindh, the second largest province of Pakistan was 37.1 thousand tones [8].

To ensure safe consumption, there is thus a need to develop methodologies to decontaminate pesticide residues in bitter gourd. Therefore, present study was designed to investigate profenofos and bifenthrin residues and effect of processing on reduction of these residues in the edibles portion of bitter gourd.

Materials and Methods

Bitter gourd was grown on two separate plots of University farm (area about half acre) sprayed with pesticides (profenofos and bifenthrin) each at the recommended dose level (250 ml/acre for bifenthrin and 800 ml/acre for profenofos) as described by Buriro, et al. [9] with Knapsack sprayer. The crop was harvested on the next day, packed in polythene bags with proper labels and were brought to the Institute of Food Sciences and Technology, Sindh Agriculture University Tandojam for house hold processing [Fig-1]. Bitter gourd samples were subjected to various traditional processing techniques such as plain washing, detergent washing and blanching. The plain washed samples were then peeled, sliced and salted to remove bitterness for 10 minutes and then washed again under running tap water. Samples were then fried and dried in cabinet dehydrator and under sun light to determine the extent of reduction of pesticide residue content.

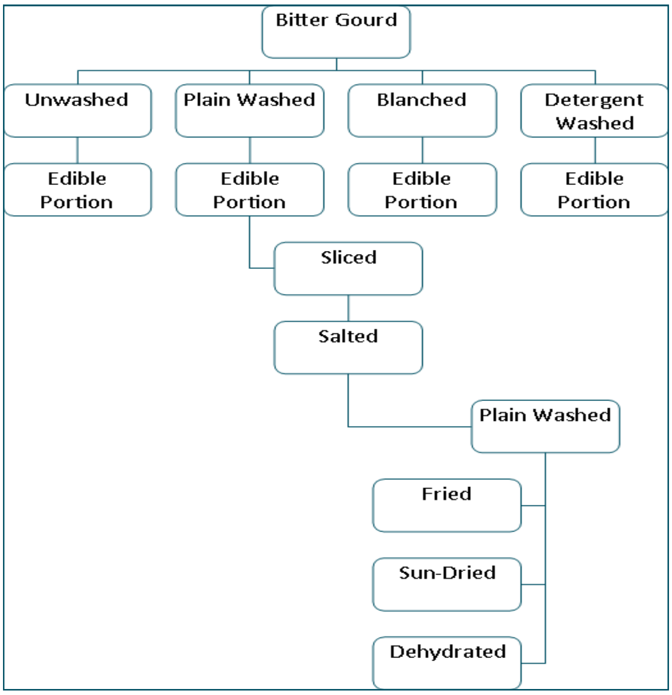

Fig. 1- Traditional Processing of Bitter Gourd

All solvents like *n*-hexane; acetonitrile (HPLC grade) used in this study, were purchased and glass distilled before use. All chemicals used were analytical/HPLC grade obtained from Scharlau (Scharlau chemie S.A. La Jota, Barcelona Spain) and ethyl acetate HPLC/Spectro grade obtained from TEDIA, USA. Sodium chloride (NaCl) 100% pure refined, anhydrous sodium sulfate (Na_2SO_4) obtained from Fischer Scientific (UK). Florisil (decolorizing powder) was obtained from BDH, England. Before use, anhydrous sodium sulfate was purified with acetone and baked for 4 h at 600°C in muffle furnace to remove possible organic impurities. Charcoal was also purchased from BDH, England. Pesticide Standards were supplied by M/s Ali Akbar Group (Pvt.), Ltd. Hyderabad, Pakistan.

For the determination of pesticide residues Agilent 7890A gas chromatography, Injector auto sampler 7683-B, Capillary column HP-5MS (30 m × 0.320 mm × 0.25µm), Detector µ-ECD was used.

Agilent (6890N) gas chromatograph system equipped with a model 7673 auto-sampler, Electron Capture Detector (all from Agilent Technologies, USA) was used for multi-residue analysis. Residues were separated through Agilent DB-1 capillary column (30 m X 0.2 5mm with 0.1 µm film) with nitrogen flow rate 30 ml / minute, air flow rate 60 ml/minute. inlet temp. 280°C, column temp 250°C, detector temperature 320°C. Pesticides with electron withdrawing groups (such as bifenthrin and profenofos) were quantified on electron capture detector. Pesticides were qualitatively determined by comparing with the retention time of the pure standards and quantitatively measured by preparing the standard curves of various concentrations with respective pure standards.

Before analysis of samples, spiked samples were processed to standardize the analytical method for quantity/quality assurance. Bitter gourd samples were collected from control plots, without pesticide spray. Bitter gourd samples were chopped into small pieces (1-1.5 cm) and mixed by tumbling. 200-250gm of divided pieces was homogenized in a blender. Twenty gm of homogenized matrix was spiked with respective pesticides in three replicates separately, at fortification level of 0.25, 0.50 and 0.75 ppm. Spiked and control samples were processed at the same time. Samples were processed in the same way as described above for extraction and cleanup. The recovery of pesticides ranged between 78 and 89.35% and was considered satisfactory by suggested techniques. Peak areas and retention time of pesticides studied in bitter gourd samples were accordingly recorded. Retention times and peak areas of the studied pesticides in samples were comparable with their standards.

Limit of detection (LOD) of pesticides was calculated at a signal-to-signal ratio of 3, while the limit of quantification (LOQ) was obtained at a signal-to-signal ratio of 10.

Results and Discussion

The results revealed that weight loss occurred during the processing of bitter gourd such as frying, sun drying and thermal dehydration. Weight loss of edible portion (50g) showed the reduction up to 12.70, 9.70 and 22.10g, respectively in sun-dried, dehydrated and fried samples with the weight loss of 74.60%, 80.60% and 55.8%, respectively [Table-1]. The results of the household traditional processing on reduction of bifenthrin and profenofos residues in edible portion of bitter gourd are given in [Fig-2], [Fig-3], [Fig-4] and [Fig-5]. The results revealed that plain washed edible portion on frying showed maximum reduction (0.11 ppm). Detergent washing process was also found effective by decreasing residue levels up to 0.29ppm where as plain washing of edible portion reduced bifenthrin residues (0.36ppm). Plain washing followed by blanching and drying processes further reduced the residue by 0.14, 0.29 and 0.49ppm during blanching, sun drying and dehydration respectively. However, it was further observed that plain water washing effectively removed the residues up to 50.6%. Washing by detergent solution further reduced the residues up to 59.7% followed by sun dried, dehydrated and fried samples i.e. 89.6, 86.9 and 93.4%, respectively. Blanching treatment also acted as an effective traditional method by which residues were reduced up to 80.7%. As such, the traditional processing played an important role in reduction of the residues below MRLs in the bitter gourd.

Table 1- Weight loss of the bitter gourd edible samples due to loss of water in different processes

Treatment	Weight (gm)	% of Control	% weight loss	Concentration Factor
Before treatment	50	100	0	1
Oil fried	22.1	44.2	55.8	2.26
Sun-dried	12.7	25.4	74.6	3.93
Dehydrated	9.7	19.4	80.6	5.15

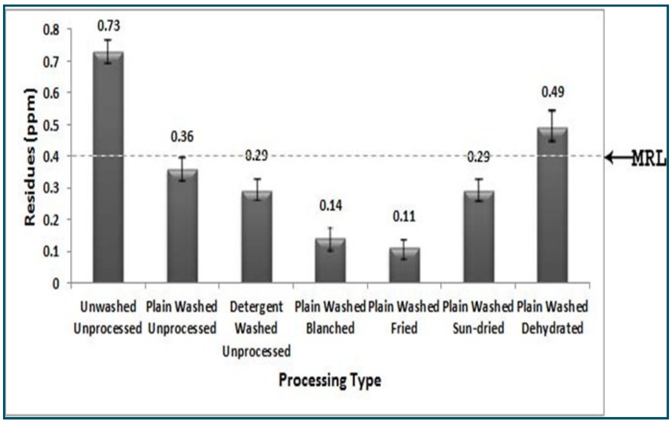

Fig. 2- Effect of household traditional processing on bifenthrin residues (ppm) in bittergourd

**Values represents mean of three experiments.*

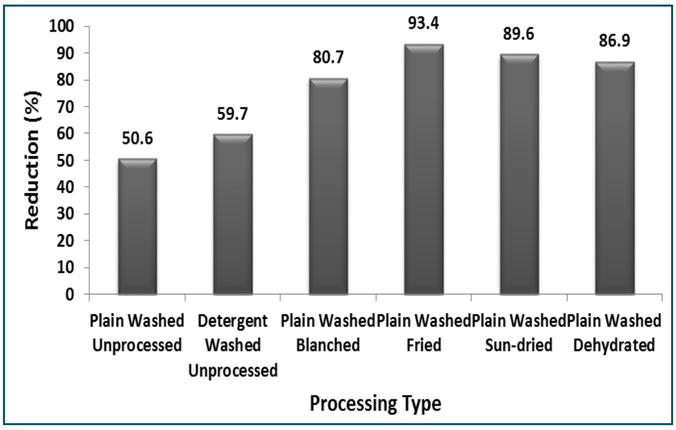

Fig. 3- Reduction (%) of bifenthrin residues in bittergourd during household traditional processing.

**Values represents mean of three experiments.*

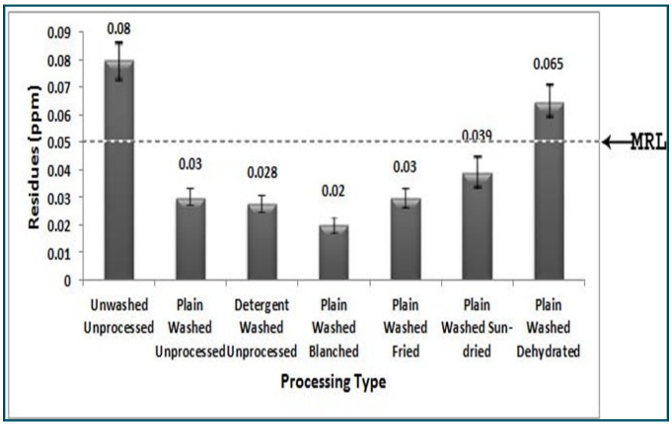

Fig. 4- Effect of household traditional processing on profenofos residues (ppm) in bittergourd.

**Values represents mean of three experiments.*

In case of profenofos pesticide residues, sun dried samples when fried reduced the residue below MRLs set by FAO. Frying was found most effective method in reduction of profenofos residue (0.03ppm) as compared to sun dried and dehydrated samples. Other traditional processing methods were found less effective in reduction/decontamination of the pesticide residues. The results further showed that the reduction percentage of profenofos by application of various traditional methods such as plain washing reduced the pesticide residue up to the level of 53.6%. Washing by detergent solution further reduced the residues up to 65.8% followed by sun dried, dehydrated and fried samples i.e. 87.9, 84.6 and 88.6% respectively. Blanching treatment further reduced the level of pesticides residues up to 78.1%.

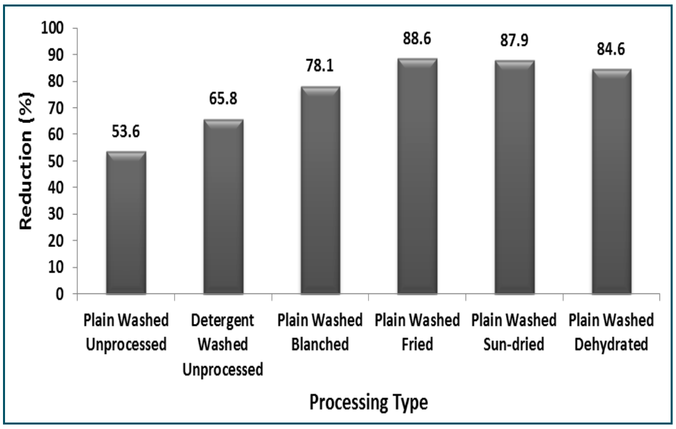

Fig. 5- Reduction (%) of profenofos residues in bitter gourd during household traditional processing.

**Values represent mean of at three experiments.*

The findings of present studies suggest that unwashed unprocessed samples of edible portion of bitter gourd contained maximum residues of used pesticides and the contents were above their respective MRLs. The traditional processing methods reduced the pesticide residues progressively. Plain tap water washing reduced considerable amount of pesticide residues up to about 45% depending upon the kind of vegetable and type of pesticides. Although by washing, residues were reduced to some extent but not completely as pesticide residues after spraying rapidly penetrate in to wax and cuticles. Thus, washing the vegetable would be insufficient in removing the pesticides. In this study, washing was found comparatively less effective in reducing the residues of bifenthrin and profenofos. The findings of the present study are consistent with some earlier reports where reduction (10-30%) of alphamethrin residues in tomato and brinjal and cauliflower was reported by Gill, et al. [10]. Moreover, Kumari [11] observed that washing was effective in dislodging the residues, however; it depended on a number of factors like location of residues, age of residues, water solubility, temperature and type of washing. Similarly, Randhawa, et al. [12] and Chauhan and Kumari, [13] reported 15 to 30% reduction of endosulfan residues in brinjal by washing. Pala and

Bilisli, [14] also supported these findings and reported that plain washing removed 30.62% endosulfan residues from tomato. The present findings are also in conformity with the above reports. Besides, washing with detergent solution also decreased the pesticide residues adsorbed on the surface of bitter gourd. Due to presence of various chemicals, this process effectively removed the fat soluble pesticide residues. As reported by Kumari, et al. [15] washing with various chemical solutions for domestic and commercial use are necessary to decrease the intake of pesticide residues. They further proposed that acidic detergent solutions were more effective in the elimination of organochlorines than alkaline and neutral solutions, as such these common and simple processing techniques acquired more significance for reducing the harmful pesticide residues in food, being cost effective as well.

Blanching on the other hand was found to be more effective than plain water washing and effectiveness was improved by further treatments of drying under sun or in cabinet dehydrator and/or cooking/frying further brought the residues below their respective MRLs. Similar observations were made by Radwan, et al. [16] that blanching and frying of eggplant (brinjal) for 5 min completely removed the profenofos residues which were initially present at the level of 0.27 ppm. This may have been due to the processes involving heat which increase volatilization, hydrolysis or other chemical degradation and thus reduce residue levels.

Blanching affects organophosphorous pesticides more than organochlorine in potatoes which withstand 100°C. Frying (after peeling) affected organophosphorous residues more than organochlorine as the percent reduction of organophosphorous ranged between 49% and 53%.The level of reduction ranged between 30.1 and 35.3% for the organochlorines. This might be due to the high stability of organochlorines to heat treatment as similar findings have also been reported by Soliman [17].

Sun drying, dehydration and frying further reduced these residues and brought them below their respective MRLs. Frying was observed to be more effective in reducing the residues in this study. The decontamination of pesticide residues by frying could be due to decomposition by the effect of heat, the stronger adsorption of pesticide onto plant tissues and or/the poor solubility of pesticides in water as reported by Abou-Arab and Abou-Donia, [18] and Ali, [19]. The processes that normally occur during cooking are volatilization, hydrolysis and thermal breakdown [20]. These results may be influenced by physico-chemical properties of the pesticides. Abou-Arab [21] found that home canning reduced organophosphorus pesticide residue levels more than organochlorine pesticide residue levels. Open systems may result in water loss during heating by evaporation, thereby concentrating the pesticide residues if they are not destroyed by heating. Similar findings have also been reported that bitter gourds treated with endosulfan sprays received initial deposits of 18.97 ppm and 26.01 ppm respectively, thus removed to the extent of 63.82% and 25.38% by 10 min of open cooking and 67.85% and 36.94% by 10 min of steam cooking [22] these results are in agreement with the findings of this study.

It was concluded that traditional processing is an effective tool for residual pesticides attenuation/reduction and suggest that conventional processing techniques if adapted, effectively reduce pesticide residues in vegetables. Pesticide residues in food are influenced by storage; handling and processing which is post-harvest of raw agricultural commodities but prior to consumption of prepared foodstuffs processing leads to large reductions in residue levels in the prepared food, particularly through washing, drying and cooking operations.

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References

[1] Dikshit A.K., Pachaury D.C., Jindal T. (2003) *Bull. Environ. Contam. Toxicol.,* 70, 1143-1150.

[2] Hussain S., Masud T., Ahad K. (2002) *Pak. J. Nutr.,* 1, 41-42.

[3] DAWN (2004) *The Daily Dawn, Internet ed*.

[4] Sudhakar K., Punnaiah K.C., Krishnayya P.V. (1998) *Indian J. Entomol.,* 60, 241-244.

[5] Rushtapakornchai W., Petchwichit P. (1996) *Agri. J.*, 24, 184-189.

[6] Hanif R., Iqbal Z., Iqbal M., Hanif S., Rasheed M. (2006) *J. Agri. Biol. Sci.*, 1, 339-342.

[7] Gupta A., Singh B., Parihar N.S., Bhatnagar A. (1988) *Pest. Res. J.*, 10, 86-90.

[8] GOP (2004) *Fruit, Vegetables and Condiments of Pakistan*, *Economic Wing, Ministry of Food Agriculture and Livestock*, Islamabad.

[9] Buriro A.S., Khaskheli A.M., Jarwar A.D. (2006) *Directorate General of Agriculture Research* Sindh Tando jam. Department of Agriculture, Government of Sindh.

[10] Gill K., Kumari B., Kathpal T.S. (2001) *J. Food Sci. Tech.*, 38(1), 43-46.

[11] Kumari B. (2008) *ARPN J. Agri. Biol. Sci.*, 3(4), 46-51.

[12] Randhawa M.A., Anjum F.M., Asi M.R., Butt M.S., Ahmed A. (2007) *J. Sci. Ind. Res.*, 66, 849-852.

[13] Chauhan R., Kumari B. (2011) *Sci. Revs. Chem. Commun.,* 1 (1), 42-48.

[14] Pala U., Bilisli A. (2006) *J. Central European Agri.*, 7(2), 343-348.

[15] Kumari B., Singh J., Singh S., Kathpal T.S. (2005) *J. Environ. Monit. Assess*, 105(1-3), 111-20.

[16] Radwan M.A., Abu-Elamayem M.M., Shiboob M.H., Abdel-Aal A. (2005) *Food Chem. Toxicol.*, 43, 553-557.

[17] Soliman K.M. (2001) *Food Chem. Toxicol.*, 39, 887-891.

[18] Abou-Arab A.A.K., Abou-Donia M.A. (2001) *Food Chem.*, 72(4), 439-445.

[19] Ali S.L. (1983) *Pharmazie Ind.,* 45, 1154-1156.

[20] Stepan R., Ticha J., Hajslova J., Kovalczuk T., Kocourek V. (2005) *Food Additives and Contaminants,* 22(12), 1231-1242.

[21] Abou-Arab A.A.K. (1999) *Food Chem.,* 64, 467-473.

[22] Nath G., Agnihotri S. (1984) *Pesticides,* 18(8), 13-15.