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Evaluation of Pesticides Status in Collected Vegetable and Fruits Samples in Growing Sites of Singrauli Region

Navneet Sharma[1], P.K. Singh[1], Vipin Dubey[1], Balendra Patel[1], B. L. Patel[1], Rajesh Pandey[2]
[1]Department of Chemistry, S.G.S. Govt Autonomus P.G. College, Sidhi, Madhya Pradesh, India
[2]Department of Biochemistry, APs University, Rewa, Madhya Pradesh, India

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ABSTRACT

Eight commercially fruits and vegetable growing sires were selected according to survey. Three fruit samples of banana, guava, and papaya and five vegetables spinach, potato, tomato, cabbage, and brinjal samples were collected from these respective sites (GFS1-GFS8) of Singrauli region. Growers undertaken with consent, they ensure and justify the application of Endosulfan and Chlorpyrifos pesticide during the cultivation of these crops. Residues of pesticide of Endosulfan, and Chlorpyriphos, were monitored in fruit and vegetables samples by Gas Chromatography (GC). All the fruit and vegetable samples were found contaminated among these in concern to fruits only papaya samples were found exceeding the maximum residue limits (MRL) of Codex Alimentarius Commission with Chlorpyrifos whereas the cabbage express more reduced as completed to other tested vegetable samples. The order of Chlorpyrifos pick areas were as Cabbage (1.14) < Banana (1.22) < Spinach (2.14) < Potato (2.29) < Guava (2.32) < Brinjal (14.41) < Tomato (10.44) < Papaya (17.41) and The Endosulfan residues order of pick areas were as potato (4.33) < Spinach (5.67) < Guava (6.17) < Banana (7.12) < Cabbage (11.61) < Tomato (19.25) < Papaya (19.78) < Brinjal (28.37).

Keywords : Fruits and vegetable, Pesticides residues, gas chromatography, Singrauli region

I. INTRODUCTION

Pesticides of different chemicals nature are currently used for agriculture all over the world. Because of their widespread, they are detected in various foods and environment matrices. Pesticides are divided into many classes, which the most important are organochlorine and organophosphorous s compounds [1]. Pests and diseases cause high losses in crop yields worldwide that can reach approximately 45% loss annually [2]. Due to the rapid growth of world population, increase in the agricultural productivity is urgent to meet rising food needs [3,4]. Chemical pesticides are considered the main component in protecting agricultural products in the field and store to maintain crop yield and quality [5,6]. Fruits and vegetables are important nutritional components in different societies. They are recommended to be eaten fresh, unpeeled, and unprocessed for their high nutritional value and content of minerals, vitamins, fibers, and antioxidants [7,8].

On the other hand, food (especially fruits and vegetables) is one of the main ways through which humans are exposed to pesticides, at a rate five times higher than other methods such as air and water [9,10]. Accordingly, efforts to ensure a sustainable use of chemical pesticides to avoid the increase of pesticide levels in the environment and food commodities are necessary. Studies have demonstrated that exposure to pesticides has dose-related chronic and acute toxicity in humans through different mechanisms including deregulation of transporters or enzymes involved in xenobiotic metabolism [11,12]. District Singrauli also affected with variable environmental issues in Madhya Pradesh State of India, due their established industries. Local fruits and vegetable grower allowed selling these growing crops in local market after needed pesticides treatments [13,14]. These crops of fruits and vegetables consume through the local population and directly indirectly exposed to them. Vegetables frequently ensure good financial return per area unit, specially because consumers often prefer products with good aspect as if that would guarantee their health and quality [15] The required rates of application of pesticides may vary, under different agricultural and climatic conditions, from country to country, and between regions of the same country [16].

Hence, the aim of this study was to determine pesticide residues in vegetable and fruit samples in local markets in Singrauli region and to show the differences and frequencies in two kinds of pesticides detection. The most common two pesticides and the type of crops their findings are also shown. This study will help understanding of the most applied these taken two pesticides on vegetables and fruits.

II. MATERIAL AND METHODS

All the fruits samples were collected specific commercially growing sites from the specific survey Singrauli region. One kg each three fruit samples of banana, guava, and papaya and one kg of each five vegetables spinach, potato, tomato, cabbage, and brinjal were collected from the field sites (GFS1-GFS8) was transported in ice box to the laboratory. These samples were chopped, sub-sampled and preserved in a freezer till further processing. The method of Tahir *et al.*, (2001) was followed for extraction and cleanup of samples.

One kg of the sample was chopped and mixed thoroughly. 25g subsample was taken and intermingled with acetone 50ml, 50h of anhydrous Sodium sulphate and 50 ml of a mixture of Cyclohexane and ethylacetate (1:1). The mixture was allowed to stand for some time until a clear supernatant was formed and 30ml supernatant was taken into a round bottom flask. A few drops of 10% propandiol in ethylacetate and about 4-6 glass beads were added. The solvent was evaporated at 40°C under vacuum in rotary evaporator. The contents were reconstituted in 6ml of cyclohexane and ethylacetate (1:1) and then passed through high-flow super cells. Two ml of this sample was applied on GPC column for further cleanup. After passing through GPC column, the samples were dried under vacuum and reconstituted in 1ml ethylacetate for analysis on Gas Chromatograph (GC). All spikes and method blank samples were processed through the entire analytical method. Quantification was based on external standard calculation using the peak area. Gas Chromatograph, Perkin-Elmer, Microprocessor was fitted with Electron Capture Detector

The analytical grade standards of insecticides (endosulfan, andchlorpyriphos were purchased form Bayer, India. Stock solutions and required working dilutions were prepared in ethylacetate. All other solvents and reagents were of extra pure GC/HPLC and analytical grade.

III. RESULTS AND DISCUSSION

Results

Evaluation of pesticides status in collected vegetable and fruits samples during 2021 and 2022

Chlorpyrifos pesticide residues (mg/kg) were examined in all processed fruits and vegetable in 2021. Maximum Chlorpyrifos were observed in papaya, whereas in vegetable maximum Chlorpyrifos was found in Brinjal 0.0926 mg/kg. Chlorpyrifos pesticides exceeding order with 10PPM reference were in vegetables were Cabbage (0.0073) < Spinach (0.0137) < Potato (0.0147), Tomato (0.0669) < Brinjal (0.0926). In fruits Chlorpyrifos residue exceeding order were Banana (0.0078) < Guava (0.0149) and Papaya (0.1141). The order of Chlorpyrifos pick areas were as Cabbage (1.14) < Banana (1.22) < Spinach (2.14) < Potato (2.29) < Guava (2.32) < Brinjal (14.41) < Tomato (10.44) < Papaya (17.41) (Table 1).

Endosulfan residues (mg/kg) were examined in processed fruits and vegetable sub samples during 2021. Maximum Endosulfan was observed in Banana fruits, whereas in concern to vegetable, maximum Endosulfan was found in Brinjal 0.0707 mg/kg. Exceeding Endosulfan residue with 10PPM reference samples were in vegetables were Potato (0.0106) < Spinach (0.0138) < Cabbage (0.0245), Tomato (0.0516) < Brinjal (0.0707). But in fruits Chlorpyrifos residue exceeding order were Guava (0.0138) < Papaya (0.0429) < Banana (0.0516). The order of Endosulfan residues pick areas were as potato (3.74) < Guava (4.87) = Spinach (4.87) < Cabbage (8.61) < Papaya (14.78) < Banana (18.19) =Tomato (18.19) < Brinjal (24.88) (Table 2 and Fig. 1).

Chlorpyrifos pesticide residues (mg/kg) were examined in all processed fruits and vegetable samples during 2022. Maximum Chlorpyrifos were observed in papaya (0.144) fruits, whereas in vegetable maximum Chlorpyrifos was found in Brinjal 0.107 mg/kg. The Chlorpyrifos residue exceeding order with 10PPM reference samples were in vegetables were Spinach (0.021) < Potato (0.022) < Cabbage (0.059) < Tomato (0.080) < Brinjal (0.107). However exceeding order of Chlorpyrifos residue in fruits were Banana (0.033) < Guava (0.079) and Papaya (0.144) respectively. The order of Chlorpyrifos residues pick areas were as Spinach (3.220) < Potato (3.470) < Banana (6.17) < Banana (5.170) < Cabbage (9.140) < Guava (12.320) < Tomato (12.410) < Brinjal (16.760) (Table 3 and Fig. 2).

Endosulfan residues (mg/kg) were in all processed fruits and vegetable sub samples during the 2022 were altrated. Most Endosulfan was in Papaya, whereas in vegetable maximum Endosulfan was in Brinjal 0.0803 mg/kg. The Endosulfan residue exceeding order with 10PPM reference samples were in vegetables Potato (0.0123) < Spinach (0.0161) < Cabbage (0.0329) < Tomato (0.0546) < Brinjal (0.0803). But in fruits Chlorpyrifos exceeding order were Guava (0.0175) < Banana (0.0202) < Papaya (0.0561) respectively (Table 4.28 and Fig 4.26). The Endosulfan residues order of pick areas were as potato (4.33) < Spinach (5.67) < Guava (6.17) < Banana (7.12) < Cabbage (11.61) < Tomato (19.25) < Papaya (19.78) < Brinjal (28.37) (Table 4 and Fig. 2).

Table 1. Chlorpyrifos pesticides residue analysis (Mg/Kg) in fruits and vegetable of Singrauli during 2020-2021

Chlorpyrifos pesticides residue analysis 2021

Samples	Sample Peak Area	Standard peak Area	Sample dilution in ml	Sample weight in (g)	PPM Reference	Total Amount in Mg/kg
Spinach	2.14	31.12	1.0	50.047	10.0	0.0137
Tomato	10.44	31.12	1.0	50.124	10.0	0.0669
Brinjal	14.41	31.12	1.0	50.017	10.0	0.0926
Cabbage	1.14	31.12	1.0	50.014	10.0	0.0073
Potato	2.29	31.12	1.0	50.118	10.0	0.0147
Papaya	17.41	31.12	1.0	49.011	10.0	0.1141
Guava	2.32	31.12	1.0	50.142	10.0	0.0149
Banana	1.22	31.12	1.0	50.014	10.0	0.0078

Table 2. Endosulfan pesticides residue analysis (Mg/Kg) in fruits and vegetable of Singrauli during 2020-2021

Endosulfan pesticides residue analysis in 2021						
Samples	Sample Peak Area	Standard peak Area	Sample dilution in ml	Sample weight in (g)	PPM Reference	Total Amount in Mg/kg
Spinach	4.87	70.34	1.0	50.047	10.0	0.0138
Tomato	18.19	70.34	1.0	50.124	10.0	0.0516
Brinjal	24.88	70.34	1.0	50.017	10.0	0.0707
Cabbage	8.61	70.34	1.0	50.014	10.0	0.0245
Potato	3.74	70.34	1.0	50.118	10.0	0.0106
Papaya	14.78	70.34	1.0	49.011	10.0	0.0429
Guava	4.87	70.34	1.0	50.047	10.0	0.0138
Banana	18.19	70.34	1.0	50.124	10.0	0.0516

Fig. 1 Pesticides residues analysis in fruits and vegetable samples during 2020- 21.

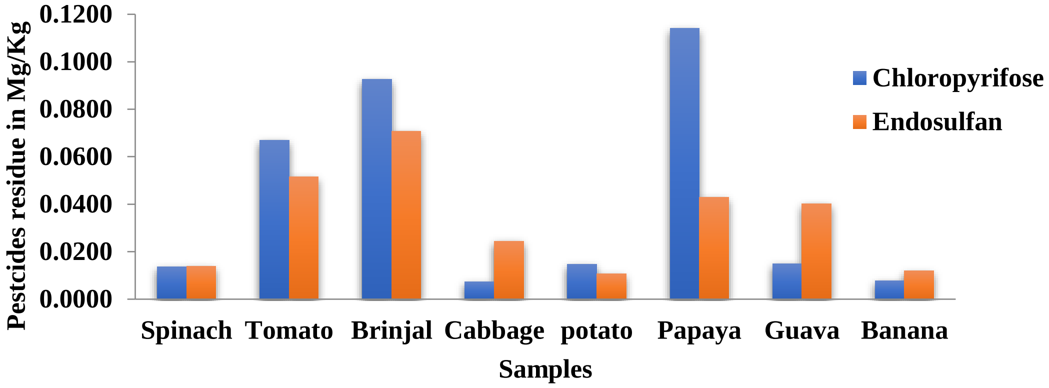


Table 3. Chlorpyrifos pesticides residue (Mg/Kg) in fruits and vegetable of Singrauli in 2021-2022

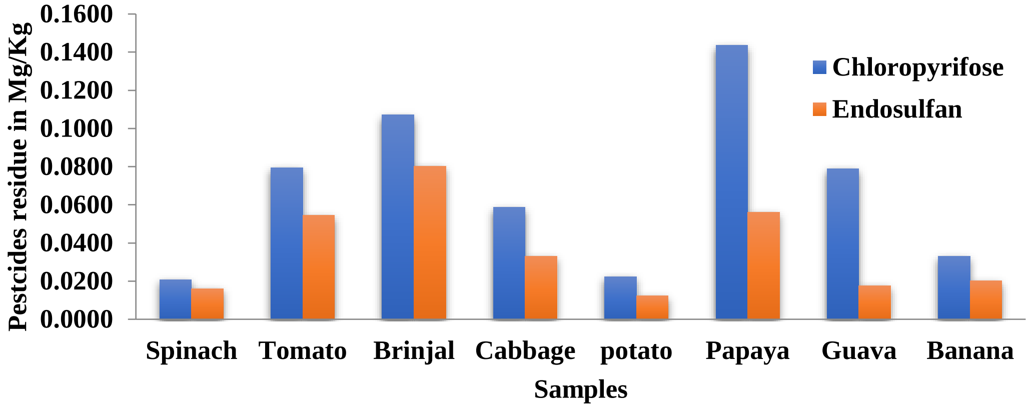
Chlorpyrifos pesticides residue analysis in 2022						
Samples	Sample Peak Area	Standard peak Area	Sample dilution in ml	Sample weight in (g)	PPM Reference	Total Amount in Mg/kg
Spinach	3.220	31.12	1.0	50.021	10.0	0.021
Tomato	12.410	31.12	1.0	50.141	10.0	0.080
Brinjal	16.760	31.12	1.0	50.213	10.0	0.107
Cabbage	9.140	31.12	1.0	50.107	10.0	0.059
Potato	3.470	31.12	1.0	50.011	10.0	0.022
Papaya	22.410	31.12	1.0	50.121	10.0	0.144
Guava	12.320	31.12	1.0	50.143	10.0	0.079
Banana	5.170	31.12	1.0	50.131	10.0	0.033

Table 4. Chlorpyrifos pesticides residue (Mg/Kg) in fruits and vegetable of Singrauli in 2021-2022

Endosulfan Pesticides residue analysis in 2022						
Samples	Sample Peak Area	Standard peak Area	Sample dilution in ml	Sample weight in (g)	PPM Reference	Total Amount in Mg/kg
Spinach	5.67	70.34	1.0	50.021	10.0	0.0161
Tomato	19.25	70.34	1.0	50.141	10.0	0.0546
Brinjal	28.37	70.34	1.0	50.213	10.0	0.0803

Cabbage	11.61	70.34	1.0	50.107	10.0	0.0329
Potato	4.33	70.34	1.0	50.011	10.0	0.0123
Papaya	19.78	70.34	1.0	50.121	10.0	0.0561
Guava	6.17	70.34	1.0	50.143	10.0	0.0175
Banana	7.12	70.34	1.0	50.131	10.0	0.0202

Fig. 2 Pesticides residues analysis in fruits and vegetable samples during 2021- 22



Discussion

Pesticides use has no doubt increased the agricultural production in general but persistent residues of these chemicals have tremendous harmful impact on the environment and also on human health. A considerable attention has been focused on the threat to human life coming from the dietary food, drinking water, and the residential risk caused by the presence of pesticide residues. The Codex Alimentations Commission of the Food and Agriculture Organization (FAO) of the United Nation and WHO have recommended respect of MRL in fruits and vegetables. Monitoring of pesticide residues is a key tool for ensuring conformity with regulation and providing a check on compliance with Good Agricultural Practice. In the developed countries many reports are available on the monitoring of pesticide residues in fruits and vegetables detected above MRLs [17-25].

The findings of the present study verify the presence of pesticides (Endosulfan and Chlorpyrifos) in fruit and vegetable samples which are used in pre- harvest treatment with different applications that cover a wide range of pests and diseases of fruit. The results of the present study are consistent with the observations previously reported for pesticide residues in fruits and vegetables (Kawamura, *et al.*, 1986), (Dogheim *et al.*, 1996 &1999) and (Blasco *et al.*, 2005 &2006). The pesticide residues have been reported in different fruits at different intervals throughout the country [26-29]. The samples analyzed were mostly found contaminated with pesticides which are in full support of the present results.

IV. Conclusion

The order of Chlorpyrifos pick areas were as Cabbage (1.14) < Banana (1.22) < Spinach (2.14) < Potato (2.29) < Guava (2.32) < Brinjal (14.41) < Tomato (10.44) <

Papaya (17.41) and The Endosulfan residues order of pick areas were as potato (4.33) < Spinach (5.67) < Guava (6.17) < Banana (7.12) < Cabbage (11.61) < Tomato (19.25) < Papaya (19.78) < Brinjal (28.37). Finding suggested that both of the investigated or evaluated pesticide Chlorpyrifos and Endosulfan accumulated and find out in the samples of fruits and vegetables. Endosulfan content was less as compared to Chlorpyrifos. Chlorpyrifos highly accumulated in leafy and pulpy vegetable samples whereas Endosulfan residues mostly found in tuber or underground vegetable samples.

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