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Development of Solvent System for Detection of Methyl Parathion in Vegetables

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ABSTRACT

In modern day practices, the use of pesticides provided unquestionable benefits by increasing the production of crop. It has the drawback of pesticide residues which remain on the vegetables, constituting potential health risk to consumer. This leads on the one hand to the establishment of legal directives to control their levels through the maximum residue level (MRLs) and on the other to continue search for pesticides, which are less persistent and less toxic for human being. In present study attempt has been made to develop solvent extraction method for detection of organophosphorous pesticides methyl parathion in cauliflower by using Thin Layer Chromatography. A total five solvent systems have been developed The data performed hRf value, Hexane: Benzene (60:40). Hexane: Benzene: Petroleum ether (60:30:10) & Hexane: Benzene : Chloroform (70:20:10) are given the best result. This method offers cheap, time saving, easy and safe alternative to typical multiresidue analysis in vegetables samples.

1. Introduction

Vegetables are the important food and highly beneficial for health. In India, vegetables are major constituents of diet as majority of people are vegetarian. Since the vegetables are important food item for Indian and limited availability for all population. However, several factors limit their productivity, mainly insect pests, and diseases. As several insect pests attack the vegetables, they are produced under very high input pressure. Among the vegetables, brinjal and cauliflower are very common and give better return over investment to the farmers.

Cauliflower (Brassica oleracea), an important vegetable crop grown in India, it is heavily attacked by various insects, resulting in severe loss of quality and production (Patel et al., 1999).

To control of numerous insect pests, different insecticides have been used (Singh et al., 2004; Sinha and Sharma, 2007). Chemical pesticides have been widely employed for effective controlling of a pest complex of various vegetable crops, but their indiscriminate use may create health hazards due to toxic residues that may persist in amounts above prescribed Maximum Residue Limits (MRL). The problem becomes more acute if the xenobiotics are used close to harvest as well as during transit and in vegetable yards. Contamination of vegetables with pesticide residues has been reported by several researchers (Madan et al., 1996; Kumari et al., 2002). The thin-layer chromatographic behaviour of carbaryl, carbendazim (Bavistin), carbofuran, propoxur, phenol, 4-chlorophenol, *o*-nitrophenol, α-naphthol and β-naphthol was examined on alumina, barium sulphate, calcium carbonate, calcium phosphate, calcium sulphate, cellulose and silica gel G in solvents such as acetone, benzene, carbon tetrachloride, chloroform, ethanol and distilled water achieved better results (Rathore and Begum,1993). Patil and Shingare(1993) described a new spray reagent for detection of dichlorvos in biological materials by thin-layer chromatography. Dichlorvos in presence of moisture breaks down to dichloroacetaldehyde which in turn reacts with phenylhydrazine hydrochloride to give a yellowish red colour.

2. Methyl Parathion

Methyl parathion is an organophosphorus insecticide that was first synthesized in the 1940s. It is relatively insoluble in water, poorly soluble in petroleum ether and mineral oils, and readily soluble in most organic solvents. In neutral and acid medium more stable in alkaline medium soon hydrolysis. Pure methyl parathion consists of white crystals; technical methyl parathion is a light tan colour with a garlic-like odour. It is thermally unstable and undergoes fast decomposition above pH 8. It is used against aphids, leaf miners, ants, and other orthopods, etc. on vegetables, paddy, wheat, cotton, tobacco, groundnut, pulses, etc.

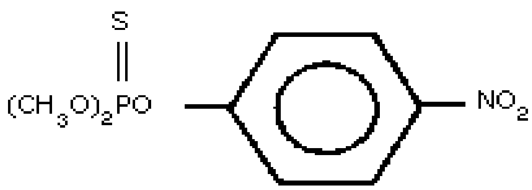

Fig. 1: Structure of Methyl parathion

3. Experimental

Material:

TLC plate (Merck), Filter paper, Distilled water, Gloves, Knife, Flask, Funnel, Test tube, Separating funnel, Beaker, Solvent chamber, Sprayer, Measuring cylinder, Glass rod, Evaporating dish, Chemical Anhydrous sodium sulphate. Petroleum ether, Acetic acid, Chloroform, Benzene, Hexane, Ethyl acetate, Acetic acid, Methanol, obtained from E Merck and Methyl Parathion standard obtained from Sigma Aldrich.

Collection of samples:

The cauliflower samples were collected from former's field which was applied methyl parathion (50% EC) pesticides application rate 1.5ml/liter and control sample also obtained which was not applied the pesticide.

Method

A total 2kg cauliflower sample collected randomly from different location of the farmer's field. The collected sample was chopped into small pieces and make fine paste with the help high-speed blender. A 200gm of sample paste was transferred to the conical flask and added 150ml of n-Hexane for extraction of the analyte and was the material kept overnight. The homozenised material transferred into separating funnel for extraction. Anhydrous sodium sulphate used to remove moisture content. The extracted material taken into rotary evaporator to make concentrated solution. The concentrated extract was applied on the TLC plate alongwith standard methyl parathion solution further the TLC plate was dried with the help of air dryer. The dried plate kept into TLC chamber to run the compound and solvent. In which five different solvent system and spraying reagent were used for detection of the methyl parathion. Spray reagent Griess was used for development of colour on the spot of the sample. The spray reagent was found to increase the sensitivity without dispensing the simplicity of the method. The same method has been followed for the control sample and found no spot for methyl parathion.

The five solvent system have been developed and found the various hRf value in the each solvent system which were found close hRf value of standard methyl parathion are given in the table:1.

Table:1 hRf Value of Methyl Parathion in Different Solvent System

S.No.	Solvent	Ratio	Standard hRf	Sample hRf
1.	Hexane : Benzene : Chloroform	70 : 20 : 10	35	34.89
2.	Hexane : Benzene : Ethyl acetate : Acetic acid	60 : 25 : 15 : 0.5	74	73.93
3.	Hexane : Benzene : Methanol : Acetic acid	70 :20 : 10 : 0.25	50	49.91
4.	Hexane : Benzene	60 : 40	60	59.97
5.	Hexane : Benzene : Petroleum ether	60 : 30 : 10	52	51.87

Calculation of Rf Values

Rf value is define as the ratio of the distance travelled by the solute to the distance travelled by the solvent.

$$Rf = \frac{\text{Distance travelled by the solute}}{\text{Distance travelled by the solvent}}$$

In the present study, modified method was adopted for calculation of Rf value.

$$hRf = \frac{\text{Distance travelled by the solute}}{\text{Distance travelled by the solvent}} \times 100$$

4. Result and Discussion

The various solvent systems have been developed successfully for the detection of the methyl parathion in the cauliflower collected from the farmer's field. The pesticides detected in the cauliflower by using various solvent system and their ratio, standard given in the table:1. shows the hRf. value of methyl parathion extracted from cauliflower in above 5-different solvent system. The data performed hRf value, Hexane: Benzene (60:40). Hexane: Benzene: Petroleum ether (60:30:10) & Hexane: Benzene : Chloroform (70:20:10) are given the best result. The solvent has been used in the study are cheap and ease of availability. The developed solvent system for detection of methyl parathion was found quick, easy, cheap, effective and time saving and the test can be conducted with less investment with best result. As the pesticides are prone to health hazard and its detection very important to minimize risk by consuming contaminated vegetables of human and animal.

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