



ORIGINAL RESEARCH PAPER

Chemistry

STUDY OF RESIDUAL PESTICIDES IN SOIL OF MAIHAR REGION OF SATNA DISTRICT IN MADHYA PRADESH

KEY WORDS: Pendimethalin, pesticidal residue, biodegradability, herbicide

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ABSTRACT In this study, some villages were selected for evaluation of pesticidal residue where excessive use of pesticides take place. Collected soil samples were analysed for various pesticidal residue. it was observed that only pendimethalin was detected in soil of Olea, Harnampur, and Berma in very small quantities. Residue of pendimethalin was obtained because pendimethalin is a slow biodegradable herbicide. Excessive use of pendimethalin may cause increment in residual concentration and can pose adverse effect. Other pesticides were not detected due to teither their good biodegradability or their fewer use.

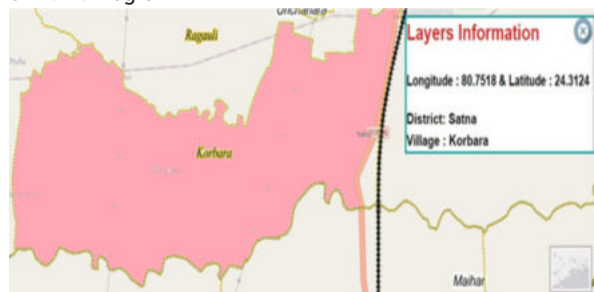
INTRODUCTION

Maihar is a Tehsil of Satna district in the state of Madhya Pradesh, India. Maihar is known for the temple of the revered Mother Goddess Sharda Maa situated on Trikuta hill. In Maihar region main living hood of people is agriculture [1]. To produce high yield of crops farmers are using different type of pesticides[2] and repeated use of these pesticides are accumulated in soil and cause adverse effect when reach at high concentration. Due to this analysis of soil is necessary in a specific time for pesticidal residue in agricultural field [3,4]. Literature reveals that no study has been done for pesticidal residue in maihar region of Satna district. On this basis some villages were selected where farming is done by modern techniques for pesticidal residue in soil. The selected villages were Kurwara, Olea, Guraeya, Harnampur and Berma. Soil samples were collected from these villages and analyzed for various pesticidal residue. It was observed that in soil of villages Olea, Harnampur and Berma except pendimethalin no other pesticidal residues were obtained. It is due to excessive use of herbicide pendimethalin in this area. In other two villages no pesticidal residue was obtained above detectable limit. A door to door survey was done in villages Olea, Harnampur and Berma for health status of people who were using pendimethalin in their agriculture field. It was also found that no hazardous effect was observed because concentration of pendimethalin was not so high to cause serious bad effect.

MATERIAL AND METHODS:

Collection Of Samples From Selected Sites At Maihar Region

Samples of soils were collected from Kurwara, Olea, Guraeya, Harnampur and Berma villages of Maihar Tehsil of Satna district. About ½ kg samples from five farms of each village were collected following standard sampling pattern that is soil samples from each corner, mid of farm were taken mixed homogenously and representative ½ kg were taken for testing and send to Institute of pesticide Formulation Technology, (NABL & APEDA accredited laboratory), Gurugram Haryana for analysis of soil from different villages of Maihar region.



Fig; 1 Village Kurwara(Korbara)



Fig;2 Village Bailakhas(Olea)



Fig;3 Village Goraiya



Fig: 4 Village Harnampur



Fig.5 Village Berma

Chemicals

Anhydrous sodium sulfate (Na₂SO₄, AR grade), sodium chloride (Hi-Media, AR grade) methanol and n-hexane solvents of pesticide residue were grade purchased from Merck (Darmstadt, Germany). The soil samples were screened for 76 pesticides viz. Propoxur, 3,4-Dichloraniline, alpha-BHC, Pencycuron, Phorate, Thiometon, Dimethoate, Dazomet, Simazine, Atrazine, beta-BHC, Propetamphos, delta-BHC, Chlorothalonil, Paraoxon Methyl, Etrinfos, gamma-BHC (Lindane), Iprobenfos, Propanil, Metribuzin, Malaoxon, Alachlor, Transfluthrin, Metalaxyl (Mefenoxam), Pirimiphos-methyl, Linuron, Malathion, Metolachlor (S-Metolachlor), Chlorpyrifos, Fenthion, Flufenacet, Pendimethalin, Fipronil, Heptachlor-*exo*-epoxide, Chlorfenvinfos, Captan, o,p'-DDE, Butachlor, Endosulfan-I, Hexaconazole, Fipronilsulfone, Profenofos, p,p'-DDE, Myclobutanil, Oxyfluorfen, o,p'-DDD, Buprofezin,

Kresoxim-methyl, Chlorfenapyr, Ethion, Triazophos, Benalaxyl, Propiconazole-1, Endosulfan sulfate, Propiconazole-2, p,p'-DDT, Diclofop-methyl, Propargite-1, Propargite-2, Etoxazole, Fenpropathrin, Fenazaquin, Phosalone, Pyriproxyfen, L-Cyhalothrin, Permethrin-1, Permethrin-2, Cyfluthrin-1, Cyfluthrin-2, Cyfluthrin-3, Cyfluthrin-4, Cypermethrin-1, Etofenprox Fenvalerate-1, Fenvalerate-2 (Esfenvalerate), Deltamethrin-1 (Tralomethrin deg.-1). The Certified Reference Material (CRM) was purchased from Sigma Aldrich (USA).

Extraction Of Soil For Pesticide Residue:

The soil samples were dried, sieved and mixed homogeneously. 20 g sample was taken in 250 ml stoppered conical flask followed by addition of 50 ml of methanol (HPLC grade) to each conical flask. Each conical flask was stoppered and subjected shaking on auto-shaker for one hour at 160 rpm. After one hour of shaking, samples were left undisturbed on flat surface for half an hour for settling of soil particles. After half an hour, 20 ml of clear supernatant was pipetted out and filtered through anhydrous sodium sulphate (Na₂SO₄), pre washed with 20 ml methanol to reduce the absorption of pesticides in the sample during clean up. All the filtrate was collected into 100 mL flat bottom round flask. Anhydrous sodium sulphate (Na₂SO₄) bed was finally washed by 10 mL of methanol (HPLC grade) into same flat bottom round flask. The solvent was evaporated near to dryness on rotary evaporator (Buchi RP-300) under vacuum (500 mm of Hg) keeping constant temperature of water bath at 40°C. The sample was reconstituted by 2mL n-hexane for instrumental analysis using gas chromatography mass spectrometry.

Standard Stock Solutions:

The stock solution of Certified Reference Materials (CRM) of pesticide was prepared. Individual pesticide weighed in volumetric flask of 10 ml. maximum up to 4mg, which was dissolved in few drops of HPLC grade acetone and make up to the mark of standard volumetric flask with HPLC grade hexane. Standard stock and working standard solution were stored in deep freezer at -20°C. 76 pesticides mixture (Organochlorine, Synthetic Pyrethroids and Herbicides) which are commonly used in India viz Propoxur, 3,4-Dichloranilline, alpha-BHC, Pencycuron, Phorate, Thiometon, Dimethoate, Dazomet, Simazine, Atrazine, beta-BHC, Propetamphos, delta-BHC, Chlorothalonil, Paraoxon Methyl, Etrifobuz, gamma-BHC (Lindane), Iprobenfos, Propanil, Metribuzin, Malaaxon, Alachlor, Transfluthrin, Metalaxyl (Mefenoxam), Pirimiphos-methyl, Linuron, Malathion, Metolachlor (S-Metolachlor), Chlorpyrifos, Fenthion, Flufenacet, Pendimethalin, Fipronil, Heptachlor-exo-epoxide, Chlorfenvinfos, Captan, o,p'-DDE, Butachlor, Endosulfan-I, Hexaconazole, Fipronilsulfone, Profenofos, p,p'-DDE, Myclobutanil, Oxyfluorfen, o,p'-DDD, Buprofezin, Kresoxim-methyl, Chlorfenapyr, Ethion, Triazophos, Benalaxyl, Propiconazole-1, Endosulfan sulfate, Propiconazole-2, p,p'-DDT, Diclofop-methyl, Propargite-1, Propargite-2, Etoxazole, Fenpropathrin, Fenazaquin, Phosalone, Pyriproxyfen, L-Cyhalothrin, Permethrin-1, Permethrin-2, Cyfluthrin-1, Cyfluthrin-2, Cyfluthrin-3, Cyfluthrin-4, Cypermethrin-1, Etofenprox, Fenvalerate-1, Fenvalerate-2 (Esfenvalerate), Deltamethrin-1 (Tralomethrin deg.-1). standard solution were prepared at six different concentration levels of **10, 25, 50, 100, 250, 500 ppb** all gave good response for MS/MS detector were considered for study.

Linearity:

The calibration graph was plotted with spiked samples (matrix match) of six different concentrations of standard mixture solutions. The mixed standard stock solution used for spiking soil samples was prepared with acetone and n hexane. The standard mixtures were analyzed by GCMS/MS at each concentration level. Calibration curve were plotted at six concentration levels with correlation co-efficient (r²) >0.99.

Sample Analysis as per following steps-

- i. Preparation of calibration solutions and injection to GCMSMS.
- ii. Analysis of prepared soil samples.
- iii. Calculation of residue content by linearity graph.
- iv. Injection of Reagent Blank and solvent blank sample to prevent false positive reporting

RESULTS AND DISCUSSION:

The calibration graph was plotted with spiked samples (matrix match) of six different concentrations of standard mixture solutions. The mixed standard stock solution used for spiking soil samples was prepared with acetone and n hexane. The standard mixtures were analyzed by GCMS/MS at each concentration level. Calibration curve were plotted at six concentration levels with correlation co-efficient (r²) >0.99. Chromatograms were obtained for soil samples of all five villages are mentioned following.

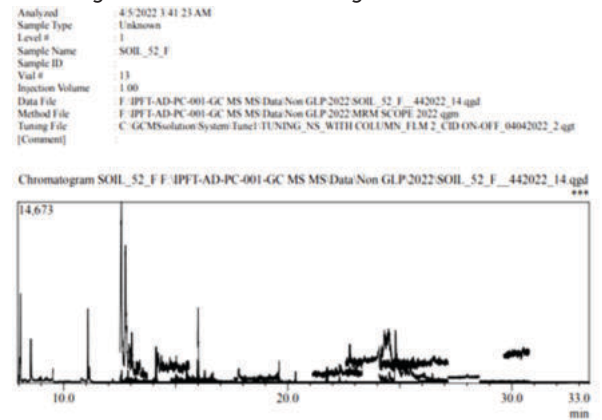


Fig: 6 Village Kurwara (Korbara) Soil Analysis Results

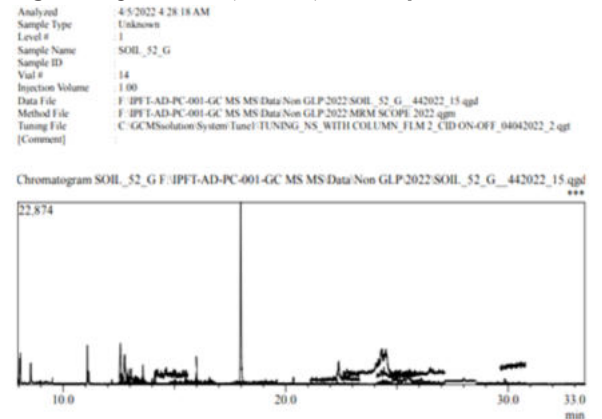


Fig: 7 Village Bailakhas (Olea) Soil Analysis Results

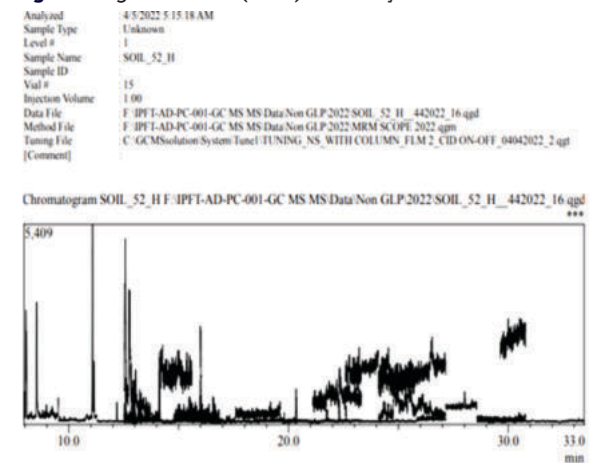


Fig: 8 Village Goraiya Soil Analysis Results

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 Sample Type : Unknown
 Level # : 1
 Sample Name : SOIL_52_1
 Sample ID :
 Vial # : 16
 Injection Volume : 1.00
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- benign synthesis of some novel biologically active 7-hydroxy-4-methyl coumarin derivatives, *Current Research in Green and Sustainable Chemistry*, 5, 100260,
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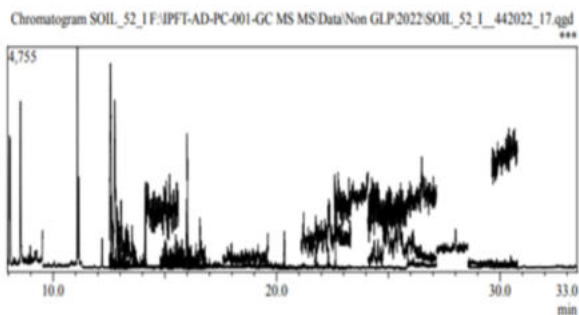


Fig:9 Village Harnampur Soil Analysis Results

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 Level # : 1
 Sample Name : SOIL_52_J
 Sample ID :
 Vial # : 17
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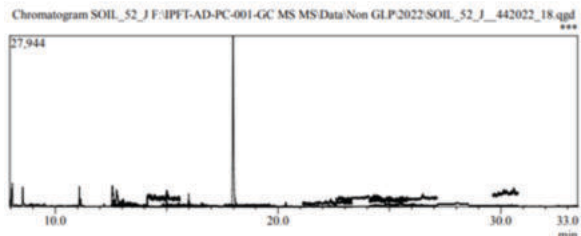


Fig:10 Village Berma soil analysis results

Above fig.6-10 chromatogram obtained from soil analysis of soil samples of villages Kurwara, Olea, Guraeya, Harnampur and Berma exhibited that no any pesticidal residue above detectable limit except pendimethalin. Pendimethalin detected in villages Olea(23.45ug/kg), Harnampur(15.44ug/kg) and Berma(26.04ug/kg) in low concentrations and no pesticidal residue was obtained in Kurwara and Guraeya. This analysis work was done for many pesticides which were being used in this area but only pendimethalin was obtained as residue. Door to door survey in these villages was resulted no adverse effect.

CONCLUSION:

In present analysis work soil samples from selected villages villages Kurwara, Olea, Guraeya, Harnampur and Berma were analysed for pesticidal residues. It was observed only pendimethalin was detected in village Olea, Harnampur and Berma. Due to very low concentration of residual pendimethalin in soil of above three village no adverse effect observed when door to door survey has been done. Pendimethalin is slow biodegradable herbicides and due to this reason it was accumulated more than easily biodegradable pesticides. Excessive use of pendimethalin in this area may increase amount of residue and can cause harmful impact.

Disclaimer

The authors alone are responsible for the content and writing of the paper.

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