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A study of Pesticide Residues in Water Samples of Agricultural Areas from H.D Kote Taluk, Mysore, Karnataka, India.

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ABSTRACT

Pesticides are biologically active chemicals which are used for killing the pests. These substances are meant for attracting, seducing of plants or animals, causing harm during or otherwise interfering with the production, and then destroying or mitigating any pest. Water samples were collected from different cultivated agricultural fields of H.D.Kote taluk and physico-chemical characteristics were experimentally determined. The analysis of physico-chemical characteristics of water showed that, parameters like Total hardness, Electrical conductivity, Sulphate were within the permissible limits of WHO standards. The Dissolved oxygen was found to be higher than the permissible limits, which indicates reduction in load of biodegradable materials in water. The Alkalinity and Nitrite showed the higher concentration indicates. In water samples pesticides were analyzed through LCMS. LCMS analysis 5 of 7 water samples; some of the pesticides were detected. In the present study areas, farmers are much familiar with pesticides to protect and boost up their crops. As a result, pesticides were present in the water bodies, which were confirmed from LCMS study. So, farmers of this area have to give more attention on their daily usage of pesticides.

KEY WORDS: Pesticides, water samples, Nitrite, LCMS

I. INTRODUCTION

Pesticides are biologically active chemicals which are used for killing the pests. These substances are meant for attracting, seducing of plants or animals, causing harm during or otherwise interfering with the production, and then destroying or mitigating any pest. Pests are a special category of animals which destroy our economic crops and biological products. According to The Food and Agriculture Organization (FAO) [15], Pesticide is any substance or a mixture of substances intended for preventing, destroying or controlling any pest, including vectors of human or animal disease, unwanted species processing, storage, transport or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances that may be administered to animals for the control of insects, other pests in or on their bodies [5,7& 8]. Major environmental consequences of pesticides are their accumulation in the body of organisms, and movement through the components of environment due to their persistence. Presently residues of certain chlorinated hydrocarbon pesticide (DDT, DDE, DDD), are widely distributed in the environment. Pesticides are chemicals used in agriculture to protect crops against destructive pests and thereby increase food supply. They are also used in public health and other areas for the eradication of disease vectors and other pests. By virtue of their widespread use, pesticides have become a major

group of environmental contaminants. When used, pesticides contaminate the environment and accumulate in the food chain thereby posing hazards to human health (Belasco et al, 2003)[8.] Pesticides belong to different chemical classes but the major ones are organochlorines, organophosphates, carbamates and pyrethroids. Organochlorines being chemically stable and persistent in the environment have been banned in most countries of world but the less persistent classes are widely in use [(10, 12 &14)].

Based on the above concept, the present work has been taken up with the following objectives:

1. To study the physico-chemical parameters of water samples collected from H.D.Kote Taluk of Mysore District.
2. To quantify the pesticide residues in the collected water samples inorder to evaluate the status of pesticide pollution.

II. MATERIALS AND METHODS

Study Area: Heggadadevanakote is a Taluk of Mysore district in the state of Karnataka. Kakanakote forest lies in Heggadadevanakote taluk. Its distance from Mysore is 50 km. As of 2001 Indian census, Heggadadevanakote had a population of 12,043. Males constitute 51 % of the population and females 49 %. Heggadadevanakote has an average literacy rate of 66 %, higher than the national average of 59.5 %: male literacy was 72 % and female literacy 60 %. Geographically H.D.KOTE, lies between 12.088^0 N, 76.328^0 E and elevation 694 m (2,277 ft). H D Kote has four reservoirs: the Kabini, Nugu, Hebbala and Taraka reservoirs. Ironically, however, agriculture in this taluk is rain-fed mainly because the government has failed to harness the capacity of the reservoirs. Barring the Kabini reservoir, the other reservoirs are always dry. As a result, farmers who could otherwise raise three crops are able to hardly raise one and are perennially in debt. This is one of the main reasons for the economic backwardness of the taluk and distress migration to cities is common. The important crops grown are paddy, Ragi, Jawar, Maize and Vegetables. The important commercial crops grown are Sugarcane, Turmeric and Cotton. Black, and red soils are commonly found in study area.

Collection of water samples: The water samples were collected from source near to agricultural fields. About 1 litre of water samples were collected in cans and stored in laboratory.

Table :1 Sampling locations of water samples in H.D.Kote Taluk-Mysore District.

Sl. No	Water sample	Name of the place	Water source
1	W-1	Yerehalli	Well
2	W-2	Yerehalli kaval	Lake
3	W-3	Yerehalli kaval	Borewell
4	W-4	Matakere	Borewell
5	W-5	Hosathoralli	Borewell
6	W-6	Hosathoralli	Lake
7	W-7	Hosathoralli	borewell

Analysis of water samples: The water samples were analyzed for pH, Electrical conductivity, Dissolved Oxygen, Biochemical Oxygen Demand, Total Dissolved Solids, Chloride, Total Hardness, Total alkalinity, Sulphate, Phosphate, Nitrate, Nitrite ,Sodium and Potassium, Fluoride .The Water pH was measured by pH meter. The Electrical conductivity

was measured by conductivity meter. The DO and BOD were determined by using Sodium thiosulphate solution. The Total alkalinity was determined using 0.1N HCl. The Chloride was determined by Silver nitrate method. The Sodium and Potassium were determined by flame photometric method The Total Hardness was determined by EDTA titration method. The Sulphate was determined by turbidimeter method The Phosphate was determined by spectrophotometric method**.** The Nitrate was determined by Brucine salt method The Nitrite was determined by Sulphanilic acid method. The Fluoride was determined by Zirconyl method.

Pesticide extraction methods: Water samples were collected from various parts of H.D.Kote Taluk of Mysore district. The samples were stored at 4^0 C in a refrigerator and all samples were extracted within 7 days using liquid-liquid partition (LLP) for LCMS analysis.

Water samples extraction: Take 20 ml of water sample and extracted with petroleum ether (2 X 20 ml) in separating funnel. The combined organic layers was dried with anhydrous sodium sulphate, filtered and keep it for vaporization for 2 days and then, add 1 ml methanol to it, mix well. Then, collect the samples in small vial for LCMS analysis.

Table: 2 Results of water samples

Parameter	WHO	W1	W2	W3	W4	W5	W6	W7
pH	6.5-8.5	8.66	7.7	7.36	8.0	7.85	7.65	8.10
Conductivity ms^{-1}	2500	200	180	1250	800	790	910	950
Chloride (mg/L)	250	53.25	71	142	46.15	60.35	88.75	106.5
DO (mg/L)	6.0	3.62	4.43	5.63	6.84	6.84	7.24	4.83
BOD (mg/L)	2.0	2.5	2	1.5	1.2	1.3	1.9	1.6
TDS (mg/L)	500	3.02	3.7	3.02	2.64	2.34	3.02	9.06
Sodium (ppm)	200	5.6	3.3	7.2	7.3	6.5	9.4	7.3
Potassium (ppm)	12	1.4	2.2	1.0	0.5	1.5	2.2	1.2
TH (mg/L)	500	160	320	560	440	432	440	440
Calcium(mg/L)	75	16	48	96	32	41.6	108.8	96
Magnesium (mg/L)	150	28.83	48.06	76.89	86.50	78.81	40.37	36.52
TA (mg/L)	500	299	624	780	611	728	780	559
Carbonate (mg/L)	50	0	0	0	39	130	0	0
Nitrite (ppm)	0.02-1.0	11.3	12.7	14.4	9.8	8.3	14.7	6.3
Nitrate (ppm)	45	2.8	15	15.9	4	2.5	6	9.5
Sulphate (mg/L)	250	165.2	107.4	49.58	66.11	57.84	45.45	41.31
Phosphate (ppm)	0.1	1.1	5.6	1.5	3.8	2.0	0.6	5.0
Fluoride (mg/L)	1.0	0.60	0.90	0.19	1.2	0.36	0.82	1.93

III.RESULTS AND DISCUSSION

pH; It is the negative logarithm of Hydrogen ion concentration. The experimental results shows, the variation of pH from 7.36 to 8.6, which indicates that, all water samples are within the permissible limits of WHO standard except, sample no W1. This indicates the presence of carbonates and bicarbonates in the water sample.

Electrical Conductivity: It is a measure of the ability of water to pass an electrical current. During the study, the conductivity ranges from 180-1250 ms^{-1}. The experimental results indicate that, the conductivity for all water samples are within permissible limits.

Classification of water according to EC.

Conductivity in ms^{-1}	classification
250	Excellent
250-750	Good
750-2500	Permissible
2500-3500	Doubtful
More than 3500	Unsuitable

Chlorides: It is often used as a disinfectant. In combination with a metal such as sodium. From the study, it was found that, the Chloride content in water samples ranged from 46.15 to 106.35 mg/L. It indicates that, all the water samples were found to be within the permissible limits. An increase in the Chlorides content in water may be due to geological processes.

Dissolved Oxygen: It measures the amount of gaseous oxygen dissolved in an aqueous solution. In this study, the DO ranges from 3.62 to 7.24 mg/L. From the study, it was found that, all the water samples were found to be within permissible limits, except **W_4, W_5 & W_7** sample. It indicates that, the increase in DO of related to decrease in temperature or decrease in dissolved oxygen.

Total Dissolved Solids (TDS): The TDS in the water samples includes all salts in solution except, suspended sediments and colloids. The total dissolved content of water is related to rock type of the substratum, degree of weathering and the residence time of the water. During the present investigations, the TDS values varied from 2.34 to 9.06 mg/L, indicating that all the water samples are within permissible limits.

Classification of water samples according to TDS

Total Dissolved Solids (mg/L)	class
Up to 500	Desirable for Drinking
500-1000	Permissible for Drinking
1000-3000	Use full for agriculture
3000-10000	Moderately Saline
10,000-35,000	Very Saline
More than 35,000	Brine

Sodium: The most important sources of Sodium salts impregnating the soils in shallow water tracks particularly in arid and semiarid regions, certain clay minerals and zeolites can increase the sodium content in water by Base Exchange reactions. An increase in sodium with considerable reduction in concentration of calcium and magnesium was observed in many of the studies. In this study, the sodium level varies from 1.5 to 3 ppm. It indicates that, all water samples are in permissible limits.

Potassium: Two factors are responsible of Potassium in water one being the resistance of potassium mineral for weathering and other being the fixation of potassium in clay mineral formed due to weathering. In the study, the potassium level varied from 1.0 to 3.8 ppm, which indicates that, all the water samples are within the permissible limits.

Total Hardness: Water samples with hardness in the range of 0 to 60 mg/L is termed soft, 60 to 120 mg/L moderately hard, 120 to 180 mg/L very hard. In the present study, values of

Total Hardness range from 160 to 560 mg/L. When compared to WHO Standards, all the water samples were found to be within the desirable limit, except **W_3**.

Calcium; The principal sources of Calcium in water are members of silicate mineral groups like plagioclase, pyroxene amphibolites, among sedimentary rocks. In the present study, the concentration of Calcium varies from 16 to 108.8 mg/L. The results indicate that, all water samples were found to be within the permissible limits.

Magnesium: Magnesium is one of two major constituents of Hardness in water, which is found in minerals such as magnetite and dolomite groups. In the present study, the Magnesium ranged from 28.83-86.50 mg/L. This shows that, all water samples are within the permissible limits.

Sulphate: Sulphate is found naturally in minerals such as, gypsum, anhydrate and pyrite. In this study, Sulphate concentration level varied from 45.45 to 165.2 mg/L. It indicates that, all the water samples were found to be within the permissible limits.

Phosphate: It is one of the essential items apart from other anions. Phosphates in water indicate degree of pollution in water body. In this study, phosphate levels varied from 0.6 to 5.6 ppm. It indicates that, all the water samples are within the permissible limits.

Fluoride: Higher concentration of fluorides is harmful and causes mottling of dental enamel during calcinations are of permanent teeth. In this study, the fluoride concentration varied from 0.19 to 1.93 mg/L. It indicates that, all water samples are within permissible limit, except W4 & W7 samples. Higher concentration of fluoride may be harmful causing spotting.

Nitrate: Nitrate pollution is considered as one major problem in many parts of India. Nitrate is a water soluble molecule made up of Nitrogen and Oxygen. It is formed when Nitrogen from ammonia and other sources combines with oxygenated water. In this study, a Nitrate level varied from 2.5 to 15.9 ppm. It indicates that all water samples are all within the permissible limits.

Nitrite: In this study, nitrite level varied from 6.3 to 14.4 ppm. Which indicates that, all water samples exceeded the permissible limits, since; Nitrite is relatively short lived in water as it quickly gets converted into nitrate by nitrifying bacteria.

Carbonates and Bicarbonates: The dissolved carbon dioxide in rain is the primary source of carbonates, In the present study, carbonates varied from 0 to 130 mg/L and bicarbonates varied from 299 to 780 mg/L, which indicates that, all water samples exceed the permissible limits of WHO standards except the W1 sample.

Biochemical Oxygen Demand (BOD): It is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic materials present in a given water samples. In this study, a water sample varies from 1.2 to 2.5 mg/L. It indicates that the samples are all within the permissible limits, except W-1 samples.

IV.CONCLUSIONS

Water samples were collected from different cultivated agricultural fields of H.D.Kote taluk and physico-chemical characteristics were experimentally determined. The analysis of physico-chemical characteristics of water showed that, parameters like Total hardness, Electrical conductivity, Sulphate were within the permissible limits of WHO standards. The Dissolved oxygen was found to be higher than the permissible limits, which indicates

reduction in load of biodegradable materials in water. The Alkalinity and Nitrite showed the higher concentration indicates. In water samples pesticides were analyzed through LCMS. LCMS analysis 5 of 7 water samples; the details of pesticides detected were presented in Table- 1. Some of the insecticides were detected and others pesticides may be converted their lower metabolites, this may be happened due to action of microorganism, climatic change and other environmental factors on unstable pesticides. In the present study areas, farmers are much familiar with pesticides to protect and boost up their crops. As a result, pesticides were present in the water bodies, which were confirmed from LCMS study. So, farmers of this area have to give more attention on their daily usage of pesticides.

Table- 2: Types of pesticides detected by LCMS analysis and their chemical characteristics

Sl No	Pesticides Detected	Structure	IUPAC Name	Mol.wt
1	Captan		[(trichloromethyl)sulfanyl]-3a,4,7,7a-tetrahydro-1H-isoindole-1,3(2H)-dione	300.59
2	Cartap Hydrochloride		S-[3-Carbamoylsulfany l-2-(dimethylamino) propyl] carbamothioate	273.8
3	Hexaconazole		2-(2,4-Dichlorophenyl)-1-(1H-1,2,4-triazol-1 yl) hexan-2-ol	314.21
4	Dimethonate		O,O-dimethyl S-[2-(methyl amino)-2-oxoethyl] dithiophosphate	229.26
5	Quinalphos		O, O-Diethyl O-2quinoxalinyl phosphorothioate.	298.3
6	Cypermethnins		[Cyano-(3phenoxyphenyl)methyl]3-(2,2-dichloroethenyl)-2,2 dimethylcyclopropane-1-carboxylate	415.06

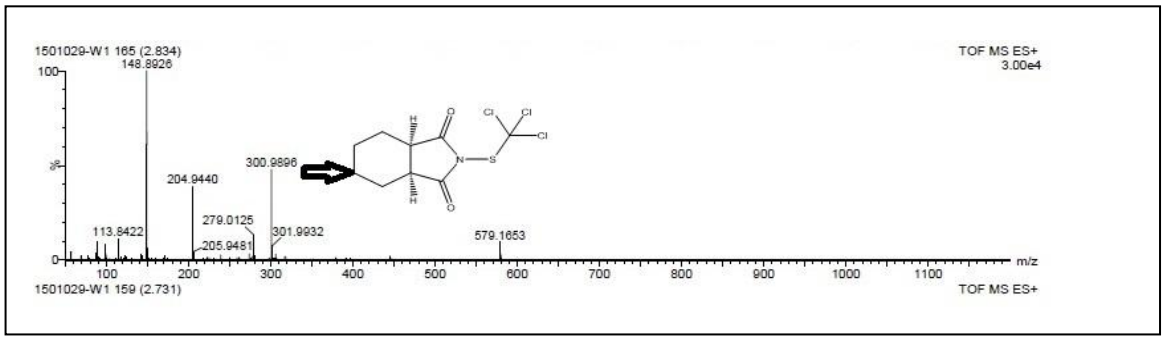

Fig 1: Mass spectra of W-1 sample show the presence of captan pesticide in water sample

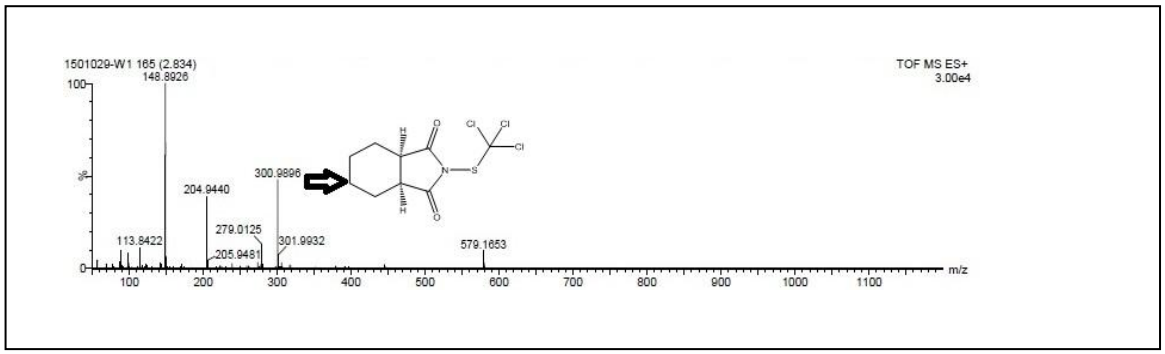

Fig 2: Mass spectra of W-2 sample show the presence of captan pesticide in water sample

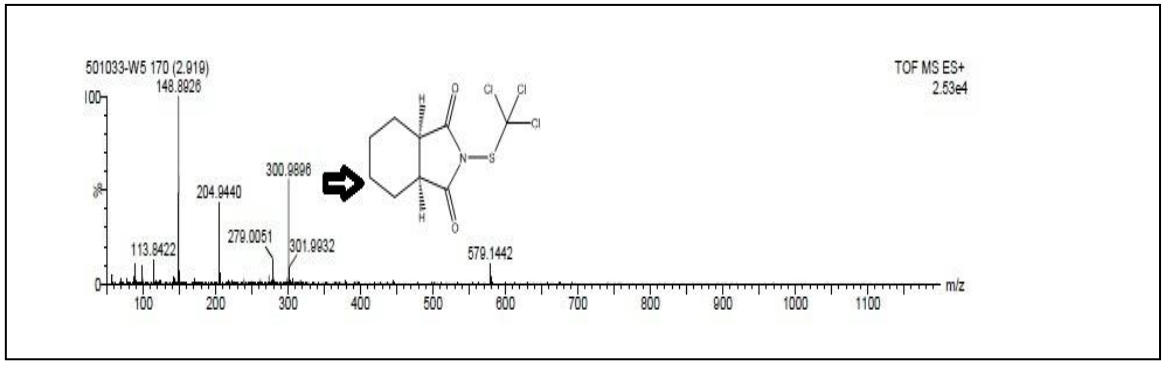

Fig 3: Mass spectra of W-5 sample show the presence of captan pesticide in water sample

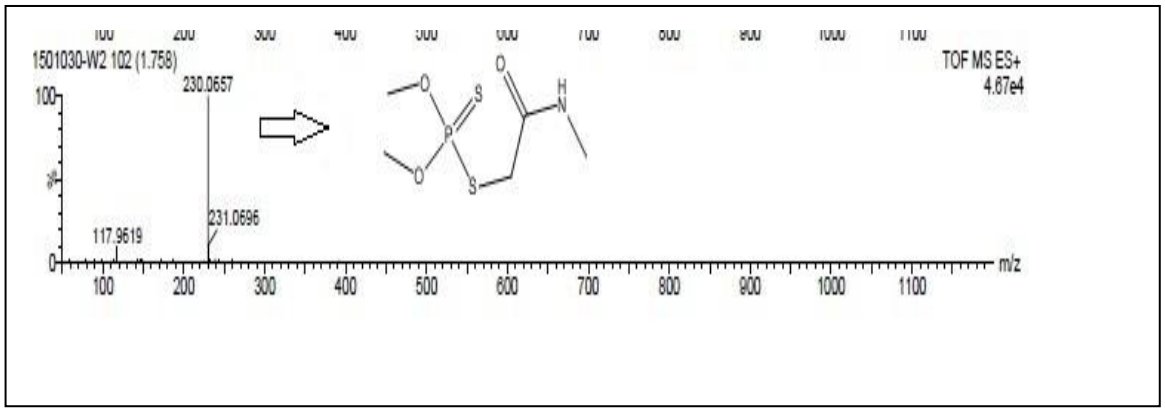

Fig 4: Mass spectra of W-2 sample show the presence of Dimethoate pesticide in water samples

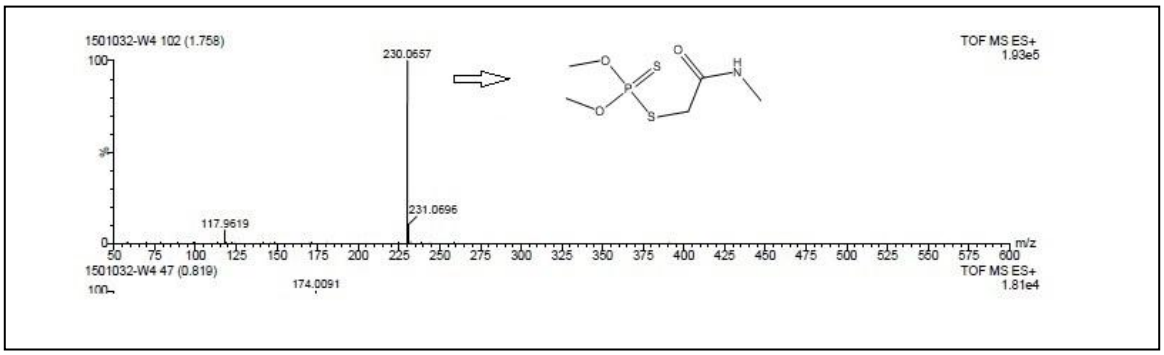

Fig 5: Mass spectra of W-4 sample show the presence of Dimethoate pesticide in water sample

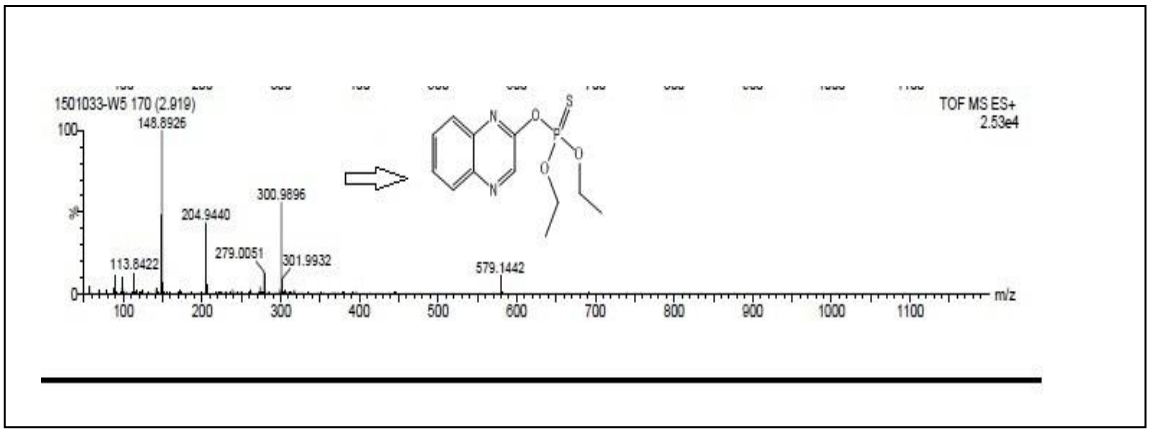

Fig 6: Mass spectra of W-5 sample show the presence of Quinalphos pesticide in water sample

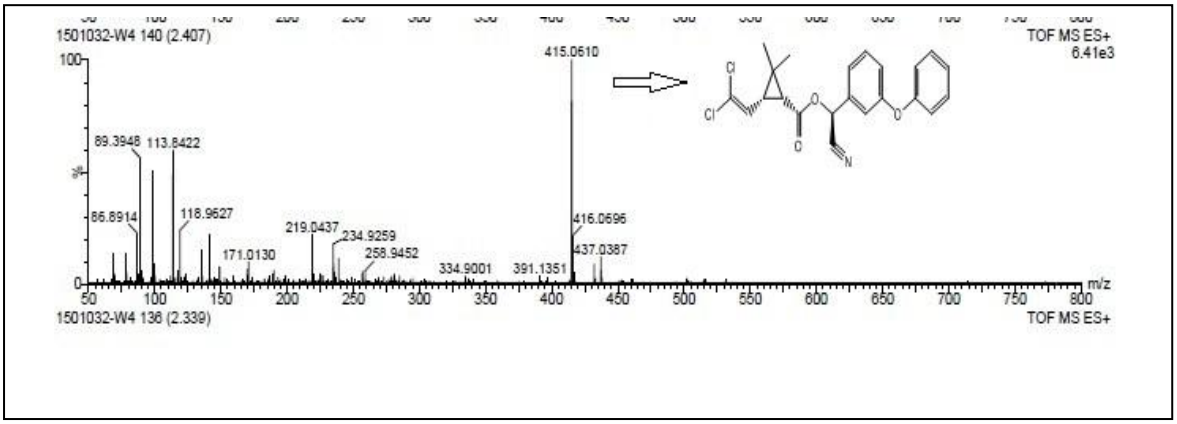

Fig 7: Mass spectra of W-4 sample show the presence of Cypermethnins pesticide in water sampl

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