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Study the Contamination Level of Organochlorine Pesticides in Fruits During Summer Season

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Abstract

Fruits have nutritional value, but they can also be sources of toxic contaminants, such as pesticide residues. Pesticides used for fruit production results in increased health risks and health costs, humiliation of the environment and productivity loss. This research aimed to conduct to estimate presence of pesticide residues in summer season fruit purchase from local market. Pesticides were precisely detected in fruitsamples collected from the market and the technique (GC-ECD) was used for analyzing and studying organochlorine pesticides in three fruits of the summer season, i.e., (plum, kiwi fruit and pineapple). The maximum residual limits (MRLs) values were compared with pesticide concentrations. In fruit sample, mean values of pesticide concentration residues were found. All fruits were found to be contaminated with pesticides. The concentrations of monitoring pesticides were less than the (MRL) values. However, the severe health problems may be created by the regular eating of pesticide infected fruits. It can be concluded that the periodical monitoring of fruits for pesticide residues is essential to evaluating their contamination grade and producing awareness on the health hazards involved in pesticide misuse.

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N-Hexane;
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Introduction

Fruits are an essential component of our diet because of their nutritional value, and have a fundamental function in the diet for the protection of physical condition and preclusion of diseases.[1] The majority of Indians are vegetarians, and their average diet constitutes about 150–250 g of fruits in the total meal per day, as was observed.[2] As several pests attack on the fruits, they are produced under very high input pressure. For better yield and quality, pesticides are frequently applied during the entire period of growth and sometimes even at the fruiting stage.[3] In a country like India, the use of pesticides has become predictable to sustain and improve the current level of crop production by protecting the crop from pests.[4] Approximately, the consumption of pesticides around the world, about two million tons per year; among them, 45%

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of pesticides are used in Europe and in USA about 25% are expended and the rest are consumed in the remaining world;about 3.75% is India's share.[5] Now days, India has turn into the 2nd largest producer of pesticides in Asia after China and they are ranks 12th worldwide.[6] The consumption of chemical pesticides, According to Ministry of Agriculture and Farmers Welfare, in the duration of 2021-2022, chemical pesticides consumption in various states was 58720 metric tons. Out of 29 Indian states, pesticide consumption in India the top four states contributing to about 62.82% are Maharashtra, Uttar Pradesh, Haryana and Telangana. The rest of pesticide 20.83% consumption in other states and 16.35% in union territories. These pesticides are absorbed by the fruits and on consumption by human beings, it may be hazardous if safe waiting period is not adopted.[7] The actual risk to human health is during the exposure of pesticide residues in major and resultant agricultural yields.[8] Thus, there are various problems of human health's which are related with pesticides, ranging from short-term impacts including nausea, headaches and skin itching, to long-term impacts has been reported,[9] including various cancers,[10-11] birth defects, infertility,[12] blood disorders,[13] nerve disorders[14] for example, amyotrophic lateral sclerosis[15] diabetes, Alzheimer,[16] Parkinson,[17] chronic lymphocytic leukemia (CLL), multiple myeloma and endocrine disruption.[18] These undesirable impacts of pesticides on the environment and human health have encouraged to researchers toward the monitoring of different kinds of pesticides in various types of food commodities. It would be economically unrealistic and practically impossible.[19] Therefore, the objectives of our present research work were to monitor of organochlorine pesticides present in selected fruits of the summer season, namely Plum, Kiwi fruit and Pineapple, because of their toxic nature, persistence and tendency to bioaccumulate as well as they have been banned in india but these pesticides are still in use.[20] Therefore, it has been decided to monitor the pesticides. Due to increasing public awareness and legal issues involved with organochlorine pesticide residues in food commodities, there is a need to harmonize the monitoring of these pesticide residues in fruits.

Materials and Methods

Reagents and Equipments

All glassware and equipments should carefully wash with deionized water and rinsed by acetone and then must dry in oven at 150°C temperature for overnight before use. For the extraction of pesticide residues from fruits following solvents like ethyl acetate, acetonitrile, acetone, n-hexane and cyclohexane should distill before used. Then, adsorbent neutral alumina, charcoal and florisil should activate before the use. Although, to eliminate probable phthalate impurities from anhydrous sodium sulphate was purify with acetone and also heated for 3h on 600°C in muffle furnace. By using the technique GLC equipped with capillary columns with[63] Ni electron capture detector purified the samples of fruits were analyzed. The small equipments like mechanical shaker, warring blender and rotatory evaporator etc. used during the study. A Stock solution of Standard was prepared in n-hexane.

Samples Collection

The sample consists of 250g of each fruit i.e. Plum (*Prunusdomestica*), Kiwi (*Actinidiadeliciosa*) and Pineapple (*Ananascomosus*), purchase from local market then deposit in refrigerator at 4ºC and analyzed within 3 days of collection. Each collected sample of fruits has been wash with water and dried up. After drying, the extraction part of fruit samples will be chopped into small pieces and macerated with 25g anhydrous sodium sulphate in warring blender to make a fine paste.

Sample Extraction

50g homogenize fine paste of each sample (Plum, Kiwi Fruit and Pineapple) and subjected to shaken separately with 100 ml acetonitrile through mechanical shaker for 3 h. Acetonitrile solvent was used for extraction previously and later this layer was discarded because it act as a polar aprotic solvent due to its low chemical reactivity, high miscibility with water. Then, extract was filtered and the remaining filtrate were transfer into the separating funnel and shaken gently for 2 h. For the first sample i.e plum (50 ml cyclohexane), for second sample i.e kiwi fruit (50 ml n-hexane) and for third sample i.e pineapple (50 ml acetone and n-hexane {1:4}) was added and again shaken for 3h. Thereafter, to obtain the two dissimilar layers, separating funnel was permitted at decent position for about 3h. The upper layer (cyclohexane from plum, n-hexane from kiwi fruit and pineapple) was separated out from separating funnel. The sample extraction was recurring three times by using 50 ml cyclohexane in plum, 50 ml n-hexane in kiwi fruit and 50 ml

acetone and n-hexane (1:4) in pineapple at each step. The collected extract was resolute at 40ºC temperature upto desiccation (5 ml) by using rotatory evaporator and then, dissolved in 5 ml n-hexane.

Purification

The composed extracts of samples will be subjected for clean up by column-packed chromatography during silica gel: activated charcoal (5:1 w/w): silica gel. Then, each extract of sample be primary passed through column as well as eluted with 40 ml n-hexane. Then, eluted extract will be more resolute upto desiccation and re-dissolved in 15 ml n-hexane for analysis of pesticides on GC-ECD.

Results and Discussion

First by running the stock solution of standards (Fig.1), we have determined retention time of peaks and peak area for the pesticides present in the standard corresponding to 0.2 µg/µl concentrations (Table.1). The peaks of different pesticides in the standard exhibited their peaks at different Rt values. The dissimilar isomers of BHC (benzene hexachloride) the peaks exhibited at Rt values 7.264 for α-BHC, 10.666 for γ-BHC, 12.108 for β-BHC and 13.553 for δ-BHC. The peak was found at Rt valve 15.230 for heptachlor and 18.093 for heptachlor epoxide, At Rt value the peak was found 16.828 for aldrin, The peak was found at Rt values as: 20.356 (endosulfan I), 23.731 (endosulfan II) and 26.861 (endosulfan sulfate), At Rt value the peak was found 22.460 for dieldrin; At Rt value the peak was found 18.655 for γ-chlordane and 19.761for α-chlordane; At Rt values the peak was found which correspond as: 23.041(endrin), 24.837 (endrin aldehyde) and 27.713 (methoxychlor). At Rt values the peaks were found as: 21.560 (4,4'-DDE), 23.459 (4,4'-DDD) and 25.122 (4,4'-DDT); The peak was found at Rt value 32.942 for endrinketone.

Table 1: Peak area and retention time of standard of organochlorine pesticides

Peak	Pesticides	Ret. Time (Rt)	Area	Area %
1	α- BHC	7.264	4056398	0.3107
2	γ- BHC	10.666	69248549	5.3044
3	β- BHC	12.108	110194348	8.4409
4	δ-BHC	13.553	67783682	5.1922
5	Heptachlor	15.230	63367599	4.8540
6	Aldrin	16.828	87205582	6.6799
7	Heptachlor epoxide	18.093	4789654	0.3669
8	γ- Chlordane	18.655	65779983	5.0387
9	α- Chlordane	19.761	82997615	6.3576
10	Endosulfan I	20.356	115947358	8.8816
11	4,4'-DDE	21.560	122612908	9.3921
12	Dieldrin	22.460	60365744	4.6240
13	Endrin	23.041	74179902	5.6822
14	4,4'-DDD	23.459	60226898	4.6134
15	Endosulfan II	23.731	59156527	4.5314
16	Endrin aldehyde	24.837	82799420	6.3424
17	4,4'-DDT	25.122	70574949	5.4060
18	Endosulfan sulfate	26.861	69382904	5.3147
19	Methoxychlor	27.713	34287889	2.6265
20	Endrin ketone	32.942	525912	0.0403
Total			1305483821	100.00

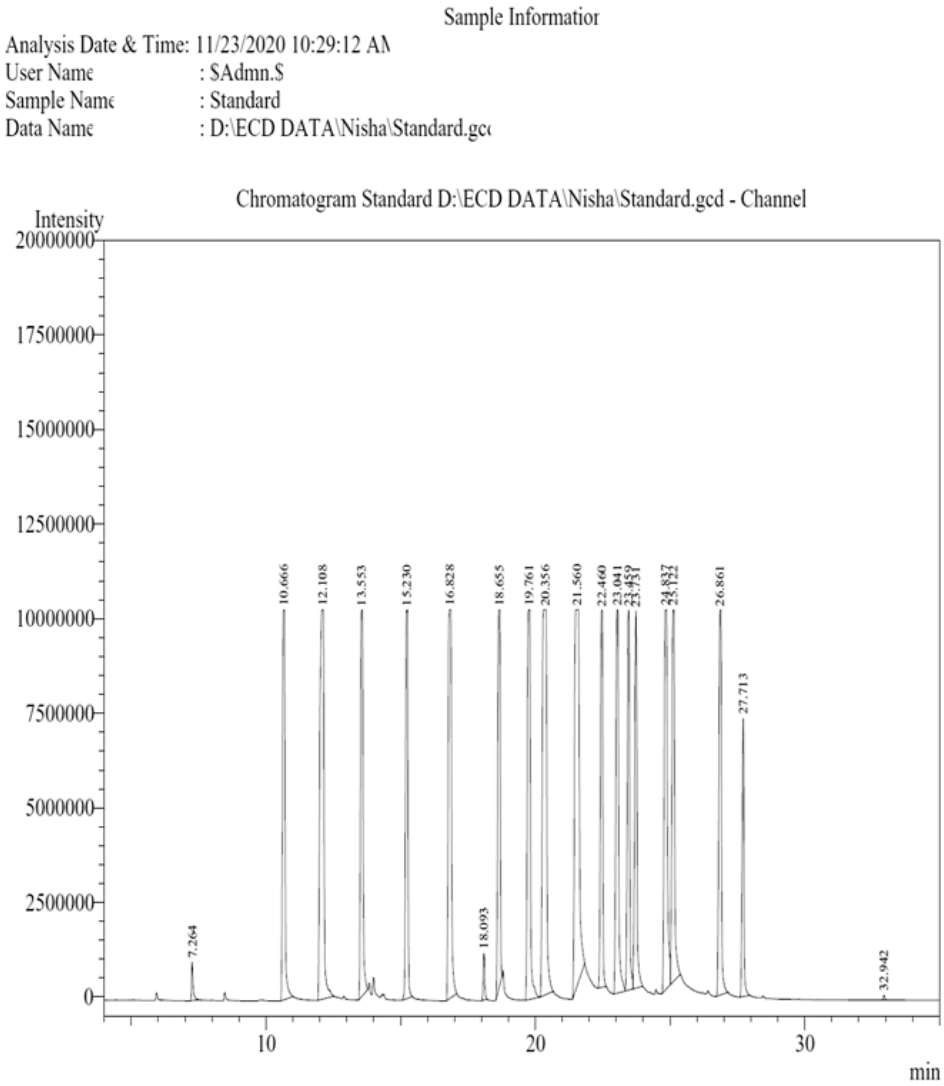

Fig. 1:-Gas chromatogram of Standard

The gas chromatogram of standard comparing withthe gas chromatogram of Plum (*Prunusdomestica*) (Fig.2) exhibited one peaks at the Rt values (retention value) 23.464 for 4, 4'-DDD and indicated the presence of exceeding pesticide in the sample of Plum. In case of the gas chromatogram of Kiwi fruit (*Actinidiadeliciosa*) (Fig.3) exhibited three peaks which were extremely close with Rt values 13.530 for δ-BHC, 16.853 for aldrinand 23.013 for endrin and indicated the existence of exceeding pesticides in the sample of Kiwi fruit. Similarly, in case of the gas chromatogram of Pineapple (*Ananascomosus*) (Fig.4) exhibited only one peaks at the Rt values 23.458 of 4,4'-DDD and indicated the existence of exceeding pesticides in the sample of Pineapple. Then, for the identification of pesticide in fruit samples was carried out by comparing with retention time of standard and retention time of samples with an average value difference and detected pesticides concentration have been reported in Table.2

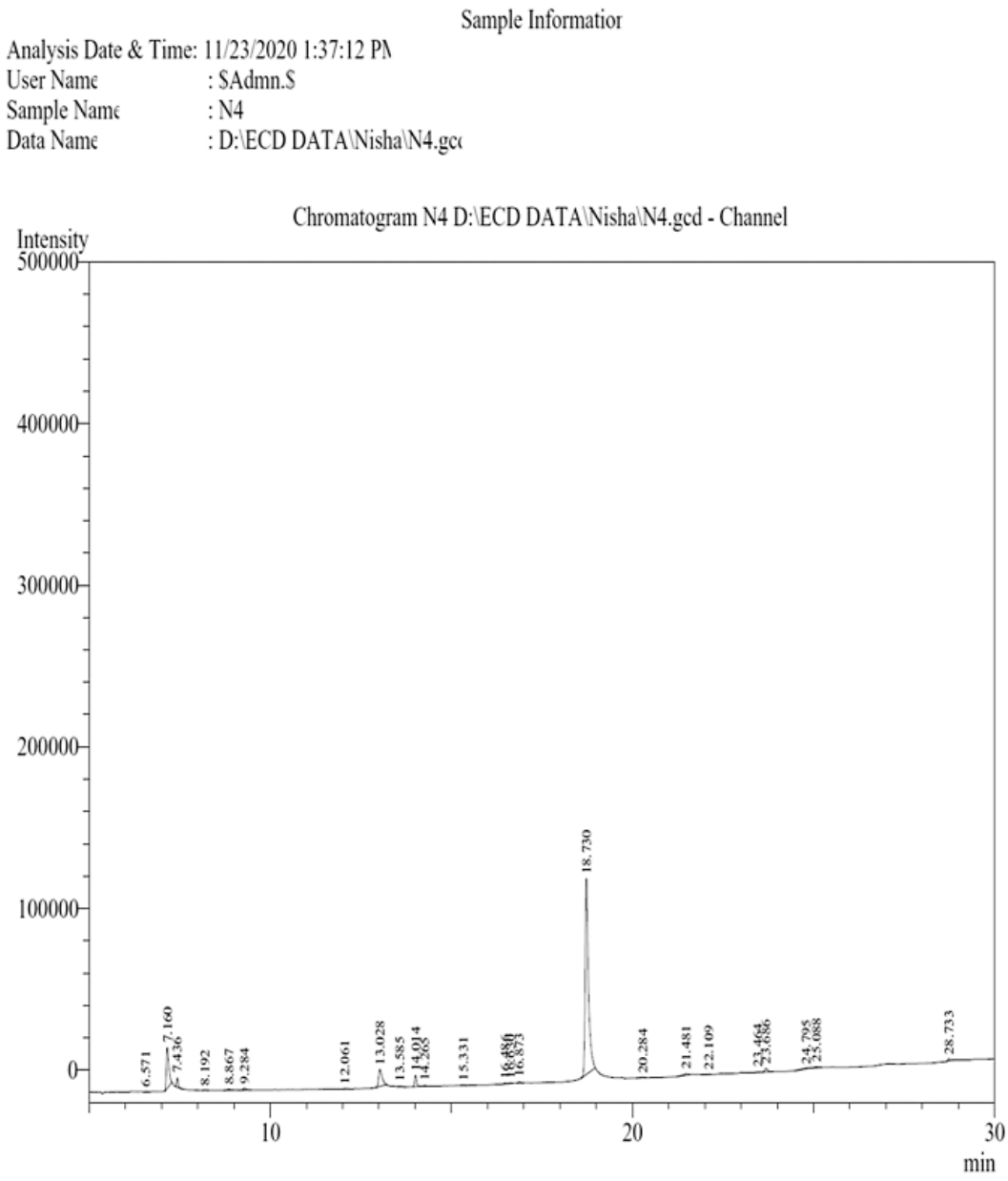

Fig. 2: Gas chromatogram of Plum

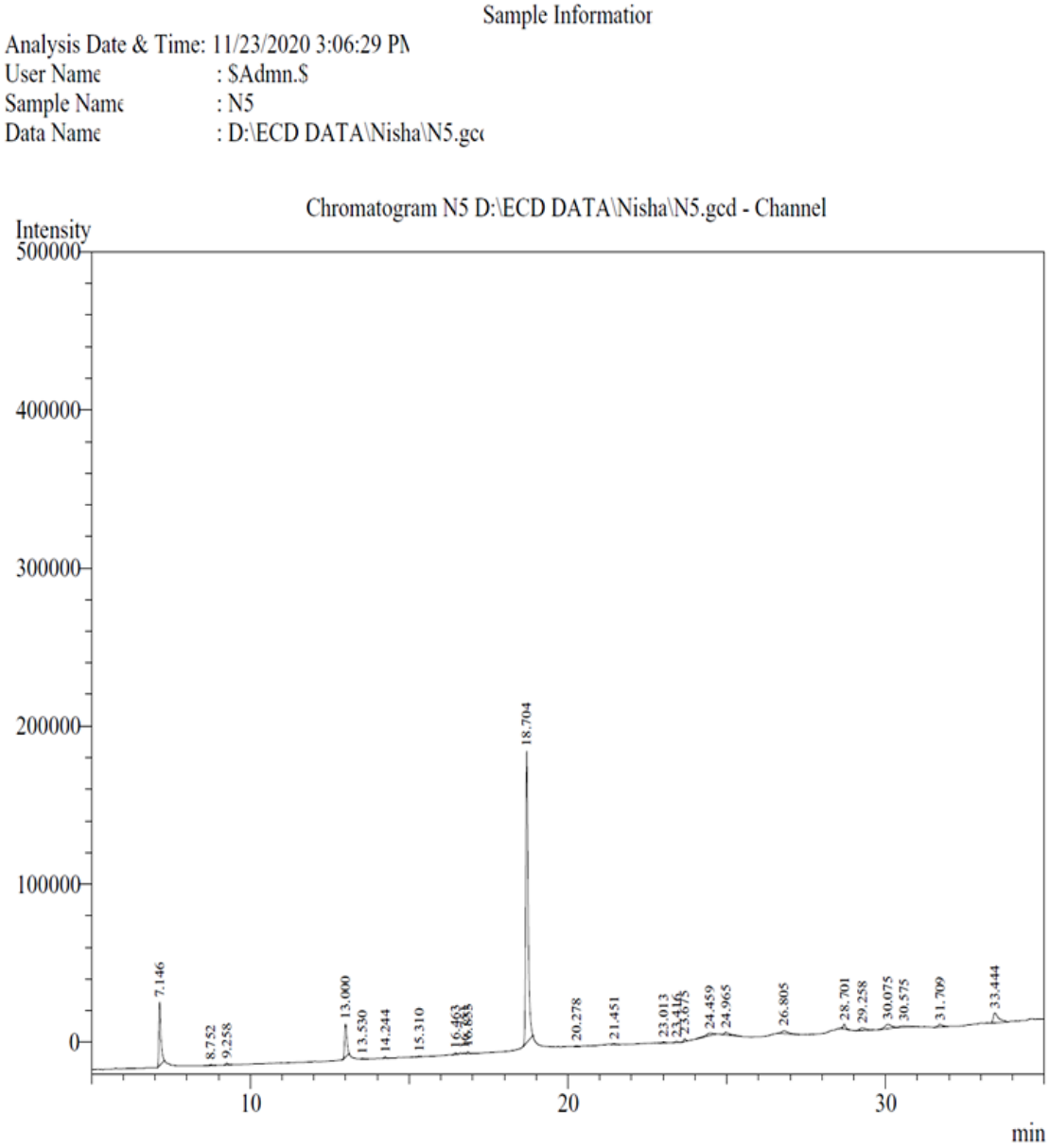

Fig 3: Gas chromatogram of Kiwi fruit

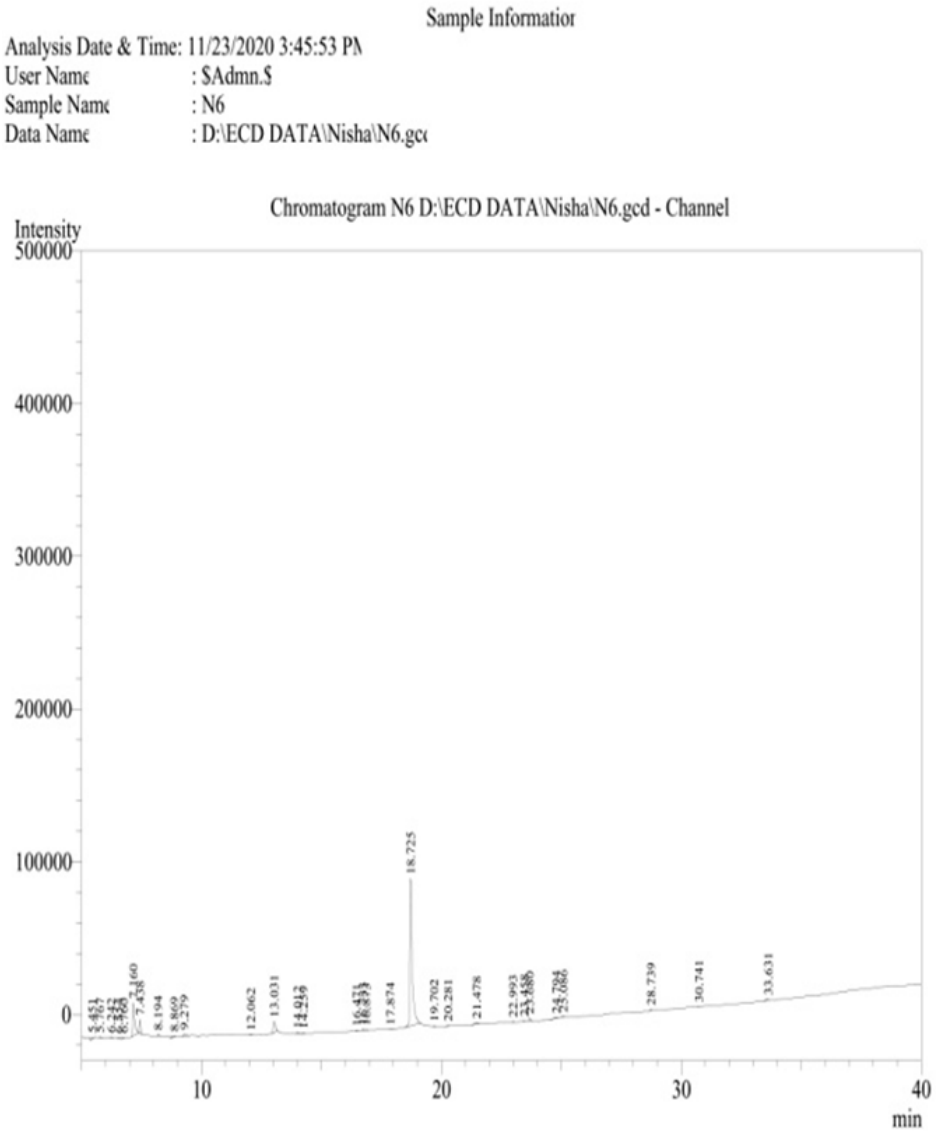

Fig. 4: Gas chromatogram of Pineapple

Table 2: Concentration of pesticides and detected pesticides with Rt value evaluated through gas chromatography

S.R. No.	Name of sample	Name of pesticide found	Ret. Time (Rt) of standard	Ret. Time (Rt) of Sample	Concentration of pesticides (µg/ml)
1	Plum	4,4'-DDD	23.459	23.464	0.00649
2	Kiwi fruit	δ-BHC	13.553	13.530	0.0044
		Aldrin	16.828	16.853	0.0110
		Endrin	23.041	23.013	0.0087
3	Pineapple	4,4'-DDD	23.459	23.458	0.00373

Conclusion

For prosecution activities as well as reduce health risk, monitoring of pesticide residues is more and more essential and important. The results of the study will indicate the contamination level of pesticides in selected fruits. We have studied the twenty organochlorine pesticides in different fruits but only five pesticides were found and all were in permissible limits.In fruit samples, there is no any pesticides were found which we have expected to be present.We have found aldrin and endrin pesticide in kiwi fruit,which have been banned for use in India. If fruits will found contaminated with pesticides then their concentration shall be compared with the MRL values set by FAO/WHO Codex Alimentarius Commission and MRL values set by Indian government. If concentration of pesticides will be found more than MRL values then farmer shall be aware to reduce the pesticides or they shall be asked to use natural pesticides by which the risk of pesticides use will be minimum to the human health and environment.

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No

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