

# Study on Bioaccumulation of Lindane in Various Tissues of *Macrogathus aculeatum* (Lac.)

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## Abstract

To study bioaccumulation level of lindane in various tissues of *Macrogathus aculeatum*, been studied for the present study, fishes were collected from nearby agricultural area, has. Tissues like muscle, kidney and liver are used for quantification of bioaccumulation level of lindane. The tissues are blended with *n*-Hexane for extraction of pesticides and then were analyzed on Gas Chromatograph (GC, model, Chemito GC 7610). The concentration of lindane found at  $0.1432\mu\text{g/g}$  in kidney,  $0.0361\mu\text{g/g}$  in muscle and  $0.1419\mu\text{g/g}$  in liver. The accepted level in general of lindane in fish has been recorded is at  $2.0\mu\text{g/g}$  (on whole basis).

**Key Words** - Bioaccumulation, Lindane, Gas Chromatograph, *Macrogathus aculeatum*.

## Introduction :

In an agricultural country like India, pesticides are a major aquatic chemical pollutant. The pesticides are a broad class of chemicals and biological agents that are purposefully introduced into the environment to damage or kill pests.

There are mainly three groups of synthetic pesticides organochlorine, organophosphate and carbonate pesticides.

The organochlorine pesticides are highly persistent, non-degradable, lipophilic and accumulative in character of different tissues of organisms (Swackhamer and Ailes 1988).

An organophosphate pesticides are less persistent and get easily detoxified in animal tissues. Carbonate pesticides are also never poisons and they also inhibit acetyl cholinesterase activity.

In this respect, Gas Chromatography (GC) has become one of the most important method of analyzing pesticides and similar compounds. GC has got excellent resolution capability and high sensitivity using different detectors and columns.

## Materials and Methods

The fish, *Macrogathus aculeatum* were collected from Kham river, Aurangabad (MS) India, it is a tributary of Godawari River, India. Four sampling areas i.e. Spot 1, Spot 2, Spot 3 and Spot 4 were selected for the collection of the fishes. These fishes were collected during the month of May and June, 2008. All of the four selected spots were at high risk of industrial and urban runoff containing traces of pesticides. The fish were immediately taken to avoid contamination during transport. The fish were killed and dissected out for taking tissues of different organs. The tissues selected for the study were body muscles, liver and kidneys.

The tissues were homogenized in small amount of water using blender and extracted by blending with 100ml. of 80% acetonitrile in water in 1000ml. capacity separatory funnel. The mixture was further extracted three times using 50ml. protein of acetonitrile. The extracts were combined and washed with 500ml. Distilled water, 50ml. of saturated sodium chloride solution and 100ml. of n-hexane. The mixture was then allowed to stand for 30 minutes and the aqueous layer was drained into another 1000ml. capacity separatory partitioning was repeated three times. All hexane proteins were combined and through a plug of 10gm. sodium sulphate into a flask. The concentrated n-hexane was subjected to clean up using Conc. Sulphuric acid in 25ml. sized separatory funnel. The solvent was evaporated till 5ml. was left and that was analyzed on GC.

The estimation of the lindane was carried out by using gas chromatograph, (GC, Chemito 7610) equipped with flame ionization detector (FID) and electron capture detector (ECD, Ni-63) and stainless steel column packed with 5% SE-30 having mesh size 80/100, length 8' and diameter 1/8'. The method was sensitive to 0.001ppm for pesticides.

Operating parameters :

Gas Flow : Nitrogen (Carrier) 20ml./min. and Nitrogen (Make up) 25ml./min.

Temperature :

Oven temperature- 180°C, Injector temperature 230°C and Detector temperature 300°C

## Observation

The values mentioned are mean values of the different spots.

**Lindane in Body Muscles** : The Table 1 value shows that the concentration of lindane in fish muscles is at 0.0361ug/g (onwholee basis).

**Lindane in Liver** : Concentration of lindane in liver is found to be 0.1419ug/g in liver.

**Lindane in Kidney** : Lindane concentration in fish kidney recorded at 0.1432ug/g.

**Table : 1**

**Concentration of lindane in various tissues of *Macrogathus aculeatum* at four selected spots  
(Concentration of lindane in tissue ( $\mu\text{g g}^{-1}$ ))**

Sampling area	Kidney	Liver	Body muscle
Spot 1 (n=4)	0.1431	0.1412	0.0361
	0.1432	0.1413	0.0360
	0.1431	0.1413	0.0359
	0.1431	0.1412	0.0359
	Mean = 0.143125	Mean = 0.14175	Mean = 0.035975
Spot 2 (n=4)	0.1431	0.1413	0.0361
	0.1431	0.1413	0.0361
	0.1430	0.1412	0.0359
	0.1431	0.1413	0.0361
	Mean = 0.14308	Mean = 0.14185	Mean = 0.03605
Spot 3 (n=4)	0.1433	0.1414	0.0362
	0.1432	0.1413	0.0362
	0.1433	0.1414	0.0361
	0.1433	0.1410	0.0363
	Mean = 0.143275	Mean = 0.1418	Mean = 0.0362
Spot 4 (n=4)	0.1434	0.1414	0.0364

	0.1435	0.1413	0.0365
	0.1435	0.1414	0.0363
	0.1433	0.1415	0.0364
	Mean = 0.143425	Mean = 0.14225	Mean = 0.0364
Mean	0.143226	0.141913	0.036156

## DISCUSSION

From the above results in clear fishes collected from all the four spots show different values of bioaccumulation of lindane in their body muscles, liver and kidney. However the values are constant for particular type of tissue.

The higher lindane bioaccumulation in liver and kidneys as compared to body muscles can be correlated to the fact that, the lindane being lipophilic in nature gets more accumulated in high lipid containing organs of body.

The levels of lindane residues are higher in kidney and liver are higher, this could be attributed to the pesticide being lipophilic; the residue and accumulate in fatty tissues. Pesticides enter fishes not only by ingestion but also through dermal absorption and respiration. When these chemicals are taken in by the fish, they bioaccumulate, biomagnify and remain in the fish till they are caught and consumed by man or eaten by bigger fishes which are eventually eaten by humans.

However, the above levels of lindane in various tissues are far below the prescribed tolerance limits of pesticide residues under the prevention of Food Alteration Act, India (23). According to this act the tolerance limit of lindane in food i.e. meat, poultry and fish is given to be  $2.0\text{mg/kg}$ . (ppm).

In above case, though, the levels of lindane in body muscles is very low when compared to PFA Act, India there is need to monitor the levels of residue as it increases with time.

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