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Statistical Estimation of the Persistence of Pesticides in Water Samples

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Statistical Estimation of the Persistence of Pesticides in Water Samples

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I. INTRODUCTION

A pesticide is a substance used to kill feral animals, insects, fungi or plants. There are thousands of different pesticides in use today. Pesticides are used in houses, shops, offices, storerooms, sheds, gardens, farms, pastoral stations. Most of the pesticides used today are chemicals which have been developed in a laboratory by scientists and produced in factories. Some pesticides are quite hazardous, as they can be harmful to humans and other living things. They can contaminate land, the air, food crops, and water ways and seriously harm or kill native animals, pets and domestic animals. In addition to being hazardous to the user, pesticides can also cause great harm and sometimes death to a person or other living things nearby, if the instructions on the pesticide container is not followed carefully.

Pesticides come in three different forms: Solids, which come in powder form (like flour), or in crystal or granular form (like sugar) liquids, which look like milky water. Aerosols, which are sprayed out in a fine mist.

While pesticides are useful for the control of various pests, many of them are hazardous chemicals. They are hazardous because they can poison the land, the water and the air.

Some pesticides do not break down for a long time. These types of pesticides are often used when something must be protected from pest attack for a long period of time, for example, protecting houses from termite attack.

Pesticides which remain in the soil or on the treated surface are also often called residual chemicals.

When residual pesticides get into the environment they can remain poisonous and active for many years. If applied incorrectly or used in the wrong place, these chemicals may spread to other land areas and possibly to the water supply.

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Sometimes people do not know that the chemical is in the ground and may dig up the soil. They may then use it for a garden or some other purpose which brings other people, their pets and other animals into contact with it. As a result, many non-target animals can be affected by pesticides In this way.

Prior to 1996, some pesticides were non-biodegradable. Some of them, such as D.D.T and Dieldrin can still be found in the environment today, although they are no longer available and have not been used for many years.

Pesticides and the food chain: In nature, plants are eaten by animals. These animals are in turn eaten by other animals, which are eaten by other animals, and so on. This is called the food chain. Along the food chain there are many different ways pesticides can accidentally contaminate animals and plants which could then be eaten by humans. Pesticides can enter the food chain at different points.

After an insect pest has been killed by a pesticide the chemical may stay in its body and still be active. If another animal eats the insect's body the pesticide will be transferred to its body and it may also be harmed by the pesticide. The second animal may of course be eaten by a third animal and it too could be harmed by the pesticide and so on.



Fig. 1: An example of a food chain

There are good reasons (advantages) for using pesticides and there are reasons for not using them (disadvantages).

Advantages of using pesticides. Modern pesticides are very effective. This means that nearly all the target pests which come in contact with these pesticides are killed. Results are quick. This means the pests are killed within a very short time.

Using pesticides can be an economical (cheap) way of controlling pests. Pesticides can be applied quickly and there is not the high labour cost which might apply to other methods of control, such as removing weeds by hand.

If pesticides are not used correctly, they can affect human health or cause serious injury or death to the pesticide operator, other people or household pets. Pesticides can also directly affect other non-target animals. For example, a gardener spraying his garden to kill caterpillars will probably also kill harmless lady bird beetles and praying mantises. If pesticides are used incorrectly or applied wrongly, they may find their way into places where they are not wanted, for example, they might be washed into rivers or into the soil. In this article an electroanalytical method voltammetry supported by statistical findings was applied.

II. INSTRUMENTS AND REAGENTS

Voltammetric estimations conducted using a model meterohm Auto Lab 101 PG stat (Netherlands). CNTPE was used as working electrode for differential pulse adsorptive stripping voltammetry and cyclic voltammetry. pH measurements were carried out with an Eutech PC'510 cyber scan. Meltzer Toledo (Japan) Xp26 delta

range micro balancer were used to weigh the samples during the preparation of standard solutions. All the experiments were performed at 25°C.

All reagents used are analytical reagent grade. Double distilled water was used throughout the analysis. In the present investigation universal buffers of pH 4.0 are used as supporting electrolytes and are prepared by using 0.2 M boric acid, 0.05M citric acid and 0.1M trisodium orthophosphate solutions.

III. MEASUREMENTS AND CALCULATIONS

In this standard addition method, the voltammogram of the unknown is first recorded after which a known volume of standard solution of the same electro active species is added to the cell and second voltammogram is taken. From the magnitude of the peak height, the unknown concentration of species may be calculated using the following equations.

$$C \text{ (un known)} = \frac{C_s x V}{V_i x i_2} x i_1$$

The values obtained is substituted in the following equations to find the amount of residue[1-13]

$$\bar{x} = \frac{1}{n} \sum x_i$$

$$s^2 = \frac{1}{n-1} \sum (x_i - \bar{x})^2$$

$$\sigma^2 = \frac{1}{n} \sum (x_i - \mu)^2$$

$$CL = 100 \times (1 - \alpha) (\%)$$

IV. ANALYSIS

Well resolvable and reproducible peak obtained for each sample is useful for the analysis of water samples. The optimum pH to get well defined peak for the detection is found to be 4.0. The peak current is found to vary linearly with the concentration of the pesticide over the range 1.0×10^{-5} M to 1.0×10^{-9} M. The lower detection was limit found to be 1.02×10^{-8} M. The correlation coefficient and relative standard deviation (for 10 replicates) obtained using the above procedure [14-20].

V. ANALYTICAL PROCEDURE

A stock solution (1.0×10^{-3} M) of each sample is prepared in dimethyl formamide. In voltammetric cell, 1 mL of standard solution is taken and 9 mL of the supporting electrolyte (pH 4.0) is added to it. Then the solution is de aerated with nitrogen gas for 10 min. after obtaining the voltammogram, small additions of standard solution are added and the voltammograms are recorded under similar experimental conditions. The optimum conditions for analytical estimation at pH 4.0 are found to be pulse amplitude of 25 mV, applied potential of -0.35V and scan rate 40 mVs.⁻¹.

Water samples are collected from paddy fields which sprayed by the pesticides under investigation 48 hours after spraying the pesticides in swarnamukhi river belt, Vakadu, Nellore district, A.P., India. These samples were filtered through a Whatman No.41 filter paper and Aliquots of water samples were taken in a 25mL graduated tube, to it buffer solution was added and analyzed as described above [21-23]. The recoveries of samples obtained in water samples ranged from 41.00 to 47.00% and the results are summarized in Table 1.0.

Table 1.0: Recoveries of pesticides in water samples

Name of the pesticide	Amount added (mg/L)	Amount found (mg/L)	Recovery (%)	Standard deviation
Dinitramine(Herbicide)	5	2.11	42.20	0.07
Bromethalin(Rodenticide)	5	2.32	46.40	0.04
Isopropaline(Weedicide)	5	2.35	47.00	0.06
Benfluraline(Fungicide)	5	2.21	44.20	0.10
Trifluraline(Fungicide)	5	2.09	41.80	0.09
Metheocarb(Acharicide)	5	2.15	43.00	0.06
Cyometrinil(Herbicide)	5	2.10	42.00	0.11
Fluxafenim(Herbicide)	5	2.08	41.60	0.08
Fenomidone(fungicide)	5	2.07	41.40	0.07
Topramezone(Fungicide)	5	2.22	44.40	0.10

**Average of 10 replicates*

VI. CONCLUSIONS

In this approach statistical parameters for the determination of pesticide residues satisfactory applied to interpret the instrumental out puts without considerable errors. And during the estimations pollution arises due to heavy metal electrodes such as mercury electrodes is avoided by using carbon electrodes.

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