

Estimation of pesticide residues in water samples by employing voltammetry

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Abstract

This investigation is to estimate amount of pesticides in water samples based on reduction behaviour of various electroactive groups by using adsorptive stripping voltammetry. Mean quantities for ten replicates founded by via carbon nano tubes paste electrodes dopped with silver nano particles as working electrodes. Statistical aspets such as standard deviation and correlation coefficient and in the entire conclusion in this effort all the probable errors are minimised and accurateness is maximised. Water samples of different regions are collected and investigated for pesticide remaining prior as well as latter the application of pesticide.

Key words: pesticide, adsorptive stripping voltammetry, carbon nano tubes paste electrodes dopped with silver nanoparticles, water samples..

Date of Submission: 10-09-2022

Date of acceptance: 25-09-2022

I. Introduction

Although pesticides has vital role in getting appreciable yields of food and related products if pesticides are not apply in proper way, they can affect human health or cause serious injury or death to the pesticide machinist, 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 ladybird 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^[1-5] supported by statistical findings was applied.

Apparatus and Chemicals

investigation conducted using a model meterohm Auto Lab 101 PG stat (Netherlands). CNTPE dopped with silver nano particals 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 was used as supporting electrolytes and are prepared by using 0.2 M boric acid, 0.05M citric acid and 0.1M trisodium orthophosphate solutions.

Computation

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.

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

Findings and Analysis

Fine resolvable 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 $1.02 \times 10^{-9} \text{M}$ to $1.06 \times 10^{-9} \text{M}$. The lower detection was limit found to be $1.02 \times 10^{-9} \text{M}$. The correlation coefficient and relative standard deviation (for 10 replicates) obtained using the above procedure.

Reclamation experiments

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 deaerated 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. 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. The recoveries of samples obtained in water samples ranged from 51.00 to 57.00% and the results are summarized in Table 1.0.

Table 1.0: Recoveries of pesticide in water samples

Name of the pesticide	Amount added (mg/L)	Amount found (mg/L)	*Recovery (%)	Standard deviation
1.Dinitramine	4.0	2.15	53.75	0.07
2.Bromethaline	4.0	2.36	59.00	0.05
3.Topramezone	4.0	2.31	57.75	0.16
4.Isopropaline	4.0	2.25	56.25	0.06
5.Cymetrinil	4.0	2.10	52.50	0.17
6.Oxabetrinil	4.0	2.18	54.50	0.07
7.Fenomedone	4.0	2.22	55.00	0.15
8.Trifluraline	4.0	2.26	59.45	0.03

*Each value is average of Average of 10 replicates

II. Conclusions

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

References

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