

Spectrophotometric determination of pesticide from water bodies using some bio adsorbents

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ABSTRACT

A sensitive and simple spectrophotometric method has been developed for the determination of Lead. The use of various low-cost adsorbents for the removal of pesticides from water and wastewater has been reviewed. Pesticides may appear as pollutants in water sources, having undesirable impacts to human health because of their toxicity, carcinogenicity, and mutagenicity or causing aesthetic problems such as taste and odors. These pesticides pollute the water stream and it can be removed very effectively using different low-cost adsorbents.

I INTRODUCTION

The removal of pesticides from water is one of the major environmental concerns today. In past few years presence of pesticide residue in the ground water resources has grown significantly and has become an intensive and burning issue of discussion. The wide range of pesticides in use makes research extremely difficult for producing a single method for the removal of pesticides that applies universally. Several methods are available for pesticide removal: photocatalytic degradation, combined photo-Fenton and biological oxidation, advanced oxidation processes, aerobic degradation, nan filtration membranes, ozonation, coagulation, fluid extraction, solid phase extraction, and adsorption. Adsorption of pesticides on carbonaceous and polymeric materials from aqueous solutions has been reviewed by Kyriakopoulos and Douliand, recently, detoxification of pesticide waste through activated carbon was reviewed by Foo and Hameed. Adsorption is a well-known equilibrium separation process and an effective method for water decontamination application. Adsorption has been found to be superior to other techniques for water re-use in terms of initial cost, flexibility, and simplicity of design, ease of operation, and insensitivity to toxic pollutants. Adsorption also does not result in the formation of harmful substances.

ADSORBENT LITERATURE

Carbonaceous Adsorbents

Adsorption process is a surface phenomenon that depends on the number of sites available, porosity, and specific surface area of adsorbent as well as various types of interactions. Generally, carbonaceous materials have a special

place among the main adsorbents, as they are known, for a long time to be capable of adsorbing various organic compounds. Activated carbon due to its high surface area and porosity is very efficient in removing different varieties of pesticides from water and wastewater. It is a versatile material that can be applied in many technological processes. A variety of activated carbon materials have been used, such as granular activated carbon (GAC), powdered activated carbon (PAC), carbon cloth, carbon fibers, black carbon, activated carbon composites, and commercial activated carbon (CAC). The forms GAC and PAC are the most used since they are considered very capable and effective materials for the adsorption of a variety of pesticides. Therefore, in recent years, many researchers have tried to produce activated carbons for removal of various pollutants using renewable and cheaper precursors, which were mainly industrial and agricultural byproducts. A wide variety of carbons have been prepared from biomass and other wastes, such as date stone, wood, biochar, coconut shell, coconut fibers, bagasse, sal wood, green waste, peat moss, horseshoe sea crab shell, corn stillage, and oil palm fronds.

Bio-adsorbents

Bio sorption is used to indicate a number of metabolism-independent processes (physical and chemical adsorption, electrostatic interaction, ion exchange, complexation, chelation, and micro precipitation) taking place essentially in the cell wall rather than oxidation through anaerobic or aerobic metabolism (biodegradation). The main attractions of bio sorption are high selectivity and efficiency, cost effectiveness, and good removal performance. Raw materials, which are either abundant (sea weeds) or wastes from other industrial operations (fermentation wastes, activated sludge process wastes), can be used as biosorbents presenting performances often comparable with those of ion exchange resins. Both living and dead (heat killed, dried, acid, and/or otherwise chemically treated) biomass can be used to remove pesticides, but maintaining a viable biomass during adsorption is difficult because it requires a continuous supply of nutrients and avoidance of organic toxicity to the microorganisms. The use of dead microbial cells in biosorption is more advantageous for water treatment because dead organisms are not affected by toxic wastes, they do not require a continuous supply of nutrients, and they can be regenerated and reused for many cycles. Dead cells may be stored or used for extended periods at room temperature without putrefaction. Their operation is easy and their regeneration is simple. Moreover, dead cells have been shown to accumulate pollutants to the same or greater extent of growing or resting cells.

II MATERIAL AND METHOD

Apparatus

A systronics (166) UV-visspectrophoto meter with 1 cm quartz cell was used for the absorbance measurements and a digital pH meter EI (111E/ 101E) was used for pH measurement.

Reagents

All chemical used were of analytical grade and distilled water was used for dilution of reagents and samples. Standard Lead (II) Stock solution (1000 Mg ML^{-1}) was prepared by dissolving 0.379 gm of $(\text{CH}_3 \text{ COO})_2\text{Pb} \cdot 3 \text{ H}_2\text{O}$ in 100 ML of water working standard solution was prepared by dilution of stock solution. Sulfuric Acid 0.4 M, 40% Hydroxyl amine hydrochloric Acid, 5% KMnO_4 , ammonical sulphite- cynide solution (350 ml conc $\text{NH}_4\text{OH} + 3 \text{ g NH}_4\text{SCN} + 10 \text{ gm. Na}_2\text{SO}_3$ diluted to 1L) and dithizone (125 mg in 500 ml. CCl_4).

Method

An aliquot of a sample solution containing Lead (II) was transferred into a flask containing 5% KMnO_4 and 2-3 drops of cone. H_2SO_4 to refluxed for 4 hours then Hydroxyl amine hydrochloride acid is added to reduce KMnO_4 after that ammonical sulphite-cynide solution and dithizone. This extract after vigorously shaking for 30 seconds, was Measured at 750 nm against the reagent blank. All samples were collected from different dugwells and tubewell of different areas of the city sagar near around garages, automobile servicing centers, places where unauthorized Lead-batteries were breaking down, painting materials manufactured by Lead are used and disposed.

II RESULT AND DISCUSSION

Most of the Sample containing Pb (II) are reported above to its ppm levels which is very hazardous. Among all samples same water sample from the places near garages, servicing centers Lead batteries and painting material disposed directly to the environment increases Pb (II) from its permissible limit (i.e. $< 0.05 \text{ PPM}$). The proposed method is fully suitable for the detection of Pb(II) in water samples and other environmental samples.

Analytical data

Beer's law was obeyed in the range of $0.2-14 \mu\text{g ML}^{-1}$. The molar absorptivity and Sandell's sensitivity for the coloured system were found to be $1.43 \times 10^4 \text{ L Mol}^{-1} \text{ CM}^{-1}$, $5.26 \times 10^{-2} \mu\text{g CM}^{-2}$ respectively. The detection limit ($\text{DL} = 3.36/5$) and quantitation limit ($\text{QL} = 106/5$) [Where is the standard deviation of the reagent blank ($n=5$) and 5 is the slope of the calibration curve] of Lead determination were found to be 0.022 and $0.072 \mu\text{g ML}^{-1}$ respectively.

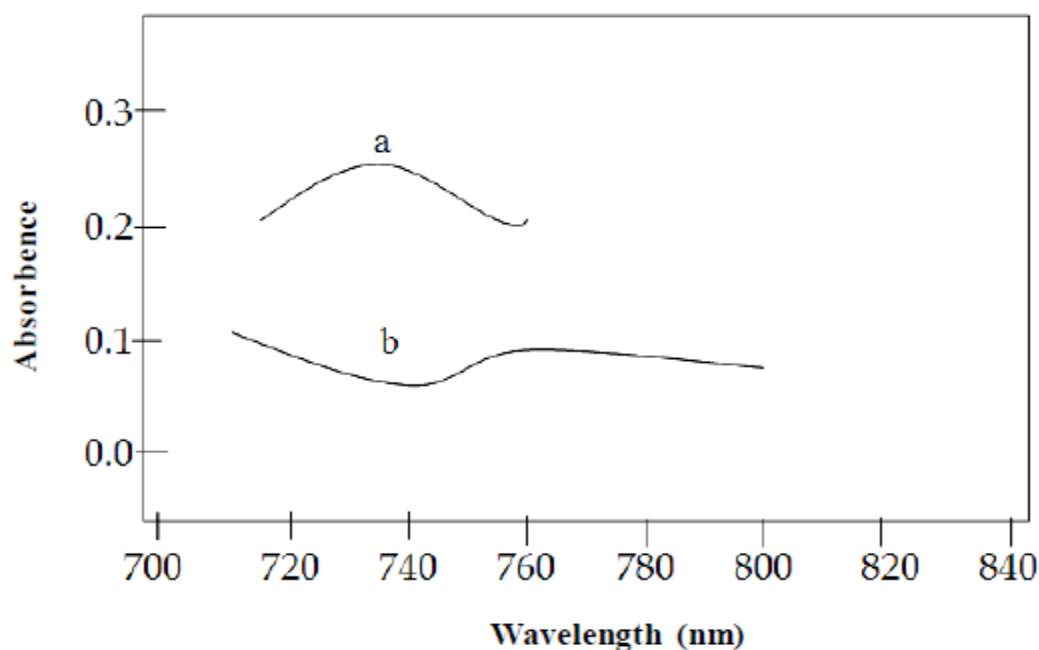


Figure 1. Absorption spectra of coloured. Species (Pb^{2+} , $1 \mu\text{g ML}^{-1}$) versus (a) reagent blank and (b) reagent blank versus distilled water

Effect of varying reaction conditions

The effect of various experimental conditions on absorbance was studied. The maximum absorbance was obtained when 1 ml of KMnO_4 , 1 drop of H_2SO_4 , 1 ml NH_2OH , HCL 1 ml, ammoniacalsulphite- cynide and 1 ml dithizonewere added in the described order. The determination was carried out at room temperature and the time taken for the maximum and constant absorbance was 5 min. The effect of pH (2-7) on absorbance revealed that optimum pH is 4. The color of the product was stable for more than 12 h.

Effect of interfering ions

The validity of the method was assessed by investigating the effect of foreign species and other common ions, Most of the cation like Fe^{3+} , Al^{3+} , Co^{2+} , Na^+ , K^+ Ni^{2+} , Zn^{2+} , Cr^{2+} , Ca^{2+} , As^{3+} etc. and anions like SO_4^{2-} , PO_4^{3-} , did not interfere. Bicarbonate sulphide, etc. also did not interfere.



Water Sample	Pb ²⁺ Found in ML ⁻¹ ± SD ^a	T- test ^b	F- test ^c
a	1.02 ± 0.02	0.62	2.25
b	2.01 ± 0.05	0.59	1.96
c	1.18 ± 0.04	0.71	1.56
d	1.29 ± 0.03	0.48	3.02
e	1.06 ± 0.04	0.65	2.41
f	2.81 ± 0.05	0.74	1.88
g	1.58 ± 0.02	0.69	2.09

Table 1 Water samples

III CONCLUSION

The process of biosorption requires further investigation in the direction of modeling, regeneration of biosorbents, and recovery of pesticides and immobilization of the waste material for enhanced efficiency and recovery. The modification of biomass to advance its removal capability has become more attractive. Despite the availability of a significant number of publications, the real and major applications of biosorption from an industrial perspective are still far from realization due to economic constraints. Most of the reported studies are performed in the batch process; this also gives a platform for the designing of the continuous flow systems with industrial applications at the commercial level. Further research is to be carried out to make the process economically viable at an industrial scale, with a focus on pesticide recovery and regeneration of agricultural waste. Finally we wish to comment on the zero waste strategy of the adsorption process in treatment of water and wastewater. There is a bigger scope of research of utilization of used adsorbents for further treatment processes. For example pesticide adsorbents can further be explored for their application in second-stage adsorption, which is a completely unexplored area of research.

REFERENCES

1. Ye J, Zhao M, Liu J, Liu W. Enantioselectivity in environmental risk assessment of modern chiral pesticides. *Environ Pollut.* 2010;158:2371–2383.
2. Rekha SN, Prasad RN. Pesticide residue in organic and conventional food-riskanalysis. *Chem Health Safety.* 2006;13:12–19.
3. Abhilash PC, Singh N. Pesticide use and application: An Indian scenario. *J HazardMater.* 2009;165:1–12.
4. United Nations Department of Economic and Social Affairs (UN/DESA). Changingunsustainable patterns of consumption and production, Johannesburg Plan on Implementationof the World Summit on Sustainable Development, Johannesburg; ChapterIII, paragraph 14–23, 2002.
5. Corsini E, Liesivuori J, Vergieva T, Van Loveren H, Colosio C. Effects of pesticideexposure on the human immune system. *Hum ExpToxicol.* 2008;27:671–680.
6. Foo KY, Hameed BH. Detoxification of pesticide waste via activated carbon adsorptionprocess. *J Hazard Mater.* 2010;175:1–11.
7. Bolognesi C. Genotoxicity of pesticides: A review of human biomonitoring studies.*Mutat Res.* 2003;543:251–272.
8. Gavrilesco M. Fate of pesticides in the environment and its bioremediation. *EngLife Sci.* 2005;5:497–526.
9. Aungpradit T, Sutthivaiyakit P, Martens D, Sutthivaiyakit S, Kettrup AAF. Photocatalyticdegradation of triazophos in aqueous titanium dioxide suspension: Identificationof intermediates and degradation pathways. *J Hazard Mater.* 2007;146:204–213.
10. Mahalakshmi M, Arabindoo B, Palanichamy M, Murugesan V. Photocatalyticdegradation of carbofuran using semiconductor oxides. *J Hazard Mater.*2007;143:240–245.
11. Vengatesan K., and S. Selvarajan: Improved T-Cluster based scheme for combination gene scale expression data. International Conference on Radar, Communication and Computing (ICRCC), pp. 131-136. IEEE (2012).
12. Kalaivanan M., and K. Vengatesan.: Recommendation system based on statistical analysis of ranking from user. International Conferenceon Information Communication and Embedded Systems (ICICES), pp.479-484, IEEE, (2013).
13. K.Vengatesan, S. Selvarajan: The performance Analysis of Microarray Data using Occurrence Clustering. International Journal of Mathematical Science and Engineering, Vol.3 (2) ,pp 69-75 (2014).
14. Sayyed same, Sarfaraz khan,K.Vengatesan, S. B , Sanjeevikumar P,Jaspreetkuar, Paper entitled “ Smart City Automatic Garbage Collection for a better Tomorrow” International Journal of Pure and Applied Mathematics, Volume 114 No. 9 2017, 455-463.