



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 11, November 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com



Chemically Modified Bio Adsorbent using in Extraction of Pb (II) Heavy Metal

Anita Kothari¹, Vandana Mathur², Neeta Kanoongo³, Shiella Tikku⁴

Department of Chemistry, S.P.C. Government College, Ajmer, Rajasthan, India

ABSTRACT: A hazardous heavy metal pollutant of wastewater is the great environmental trouble and endangers people at some point of the world due to fast urbanization and industrialization. Adsorption procedures are being broadly utilized by diverse researchers for the elimination of heavy metals from waste streams and activated carbon has been regularly used as an adsorbent. The preparation of activated carbon from coconut husk with H₂SO₄ and with the aid of using rice husk changed with tartaric acid. Modification of agricultural by-product could enhance their natural capacity and add value to these by-products. The extent of adsorption was studied as a function of pH, contact time, adsorbent dose, and initial metal ion concentration.

KEYWORDS: Heavy metal, coconut husk, rice husk, adsorption, parameter.

I. INTRODUCTION

Heavy elements that enter water and soil resources are absorbed by plants and animals and enter the human food chain, causing dangerous and incurable diseases [1]. Researchers have always claimed that heavy metals have deleterious effects and it is necessary to remove and purify these metals from water and soil [2]. By offering the pros and cons of heavy metal removal methods, it is possible to easily select a suitable method in terms of cost and access to technical knowledge [3]. Excessive levels of heavy metals in soil and water is a major problem that can threaten ten aquatic ecosystems, agriculture, and public health [4]. It is possible to damage the environment through human activities such as mining, production of metal bars such as lead, zinc, copper, cadmium, etc., production of fuel and energy, use of agricultural pesticides, production of batteries, and painting with heavy metals [5]. These metals can enter the body directly through water, air and soil (drinking water and respiratory air contaminated with heavy metals) or indirectly (consumption of products, fruit and meat from animals treated with heavy metals). Due to the lack of decomposition and decomposition, these metals accumulate in the body and cause many problems in the body [6].

Low-cost attractions In general, adsorbents are said to be cheap because they require few processing methods or are abundant in nature and may even be a by-product of industry. Natural substances or wastewater from industrial or agricultural activities are an important source of cheap absorbers [7].

The objective of this work is to study the adsorption behaviour of some low-cost adsorbents such as coconut husk and rice husk for extraction of lead. The batch method was employed: parameters such as pH, contact time, and initial metal concentration, were studied.

II. RELATED WORK

The removal of heavy metals with inexpensive adsorbents is very convenient; This research attraction was developed by utilizing agricultural and industrial waste [8]. Commercially, adsorbents must have high selectivity to facilitate separation, easy transportation, kinetic properties, thermal and chemical stability, mechanical strength, resistance to deposition, regenerating, and low solubility in liquids. The adsorption process has many advantages over traditional heavy metal removal processes. The advantages of the adsorption process include economy, metal selectivity, reproducibility, absence of toxic algae, metal recovery and, most importantly, the efficiency of this process. The most abundant absorbers are agricultural waste, industrial by-products, natural products or modified biopolymers [9]. Okafor et al. [10] also explored the adsorption capacity of Coconut (*Cocos nucifera* L.) shell for Cu(II) from aqueous solutions. The efficacy of coconut tree sawdust (CTS) as alternative low-cost biosorbent for the removal of Cu(II) ions from aqueous solutions was investigated by Wiwid et al. [11].



III.METHODOLOGY

Modification process of coconut shell

Coconut shells are obtained from the local markets and were used as precursors. Firstly, they were washed with distilled water to remove any adhering impurities, and then dried at 110 °C for 24 hr followed by grinding and sieving in order to use particles size ranged between 1 mm and 2 mm. The carbonized sample was cooled and soaked with certain weight of H₂SO₄ (20 g of carbonized sample with 60 g of H₂SO₄ (50%)) in 100 ml distilled water for 24 h at room temperature, followed by drying at 110 °C and finally activated at 600 °C for 4 h. Prepared sample was washed several times with distilled water till neutral filtrate and then dried at 110 °C to constant weight and finally stored in a clean dry glass bottle.

Modification process of rice husk

About 5 g grinded rice hull was mixed with 35 m L of 1.2 M Tartaric Acid (TA). The mixture was stirred until homogenous and dried at 50°C overnight. The treated rice hull was subsequently washed with distilled water until neutral and dried overnight at 50°C. The final product was labeled as Tartaric Acid Modified Rice Hull (TARH)

Chemical and reagents:

Stock solutions of lead chloride as used as adsorbate, and solutions of various concentrations were obtained by diluting the stock solution with distilled water. Lead Concentration was determined by spectrophotometer. All the chemicals used were of analytical grade reagent .

Methodology:

Batch adsorption experiments were carried out by shaking a series of bottles containing various amounts of the different adsorbents used and heavy metal ions separately at optimum pH.

Heavy metal Pb (II) detected by flame AAS (Atomic absorption spectroscopy).The percentage of metal ion removal was calculated from following equation:

$$\% \text{ Removal} = (C_0 - C_e) / C_0 \times 100,$$

Where C₀ is the initial concentration of metal ion and C_e is the metal ion concentration at equilibrium.

IV. RESULTS AND DISCUSSION

1. Effect of initial concentration of the metal ion: The percentage removal of Pb(II) was studied by varying Pb (II) ions concentration from 5 to 25 ppm at constant adsorbent dose and keeping other parameters at optimum conditions. It is clear from Figure 1 that as the concentration of lead ions in the solution increases, the percent adsorption of lead decrease rapidly from 84% to 66% and 88% to 69% by coconut shell and rice husk respectively.

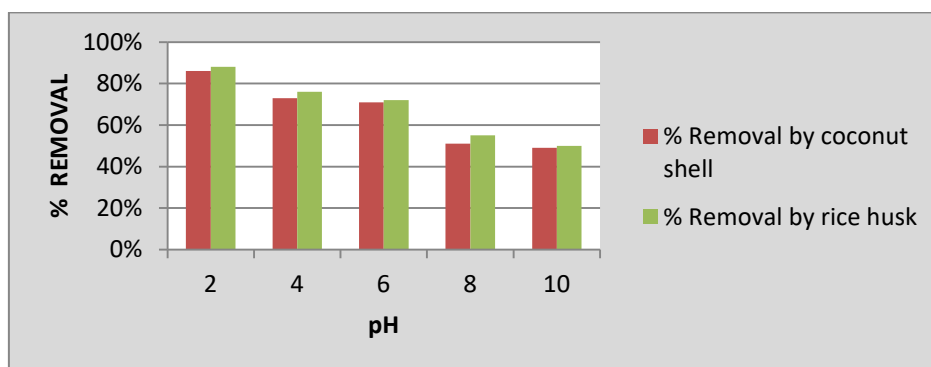


FIGURE-1 EFFECT OF INITIAL METAL ION CONCENTRATION



2. Effect of pH: The pH was varied from 2 to 10 for Pb (II) and the pH of the solutions was adjusted to different values using suitable buffers. The removal efficiency was calculated at constant bio adsorbent weight and concentration of the metal ion. A figure 2 shows the uptake of Pb (II) which is depends greatly on pH .The metal ions are nearly stable at pH 2 in Pb (II) respectively due to stability of complexation of the metal ion with coconut shell and rice husk.

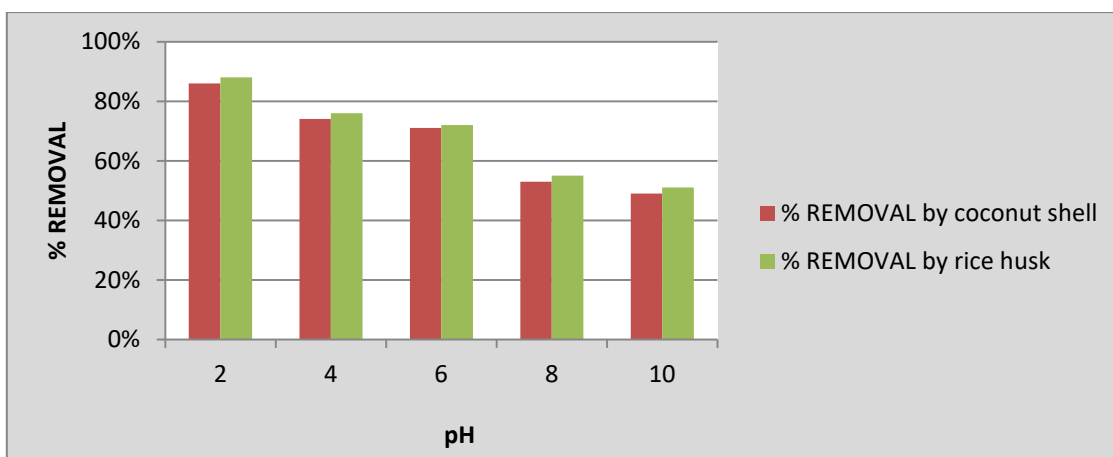


FIGURE-2 EFFECT OF pH

3.Effect of adsorbent weight: Different amount of bio adsorbent was added in industrial water samples at constant pH, constant concentration of the metal ion and at constant contact time. According to figure 3 maximum percentage removal of Pb (II) in water samples takes place at 6 mg weights. Metals adsorption efficiency was increased with increase in an adsorbent dose. This revealed that the adsorption sites remained unsaturated during the adsorption reaction whereas the number of sites available for adsorption site increases by increasing the adsorbent dose.

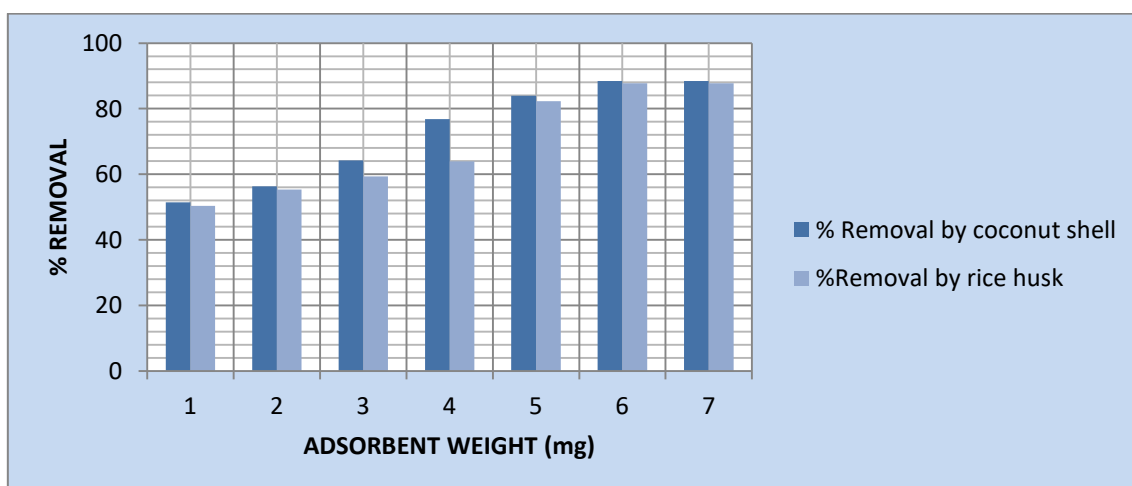


FIGURE-3 EFFECT OF ADSORBENT DOSE

4.Effect of contact time: The effect of contact time on the percentage removal of Pb (II) metal ion by different bio adsorbent. Effect of contact time is calculated at constant pH, biomass, and constant initial metal ion concentration. Figure 4 shows maximum percentage removal of heavy metal in 20 and 25 minutes by coconut shell and rice husk respectively. Adsorption rate initially increased rapidly, and the optimal removal efficiency was reached within about 20 - 25 min. Further increase in contact time did not show the significant change in equilibrium concentration; that is, the adsorption phase reached equilibrium.

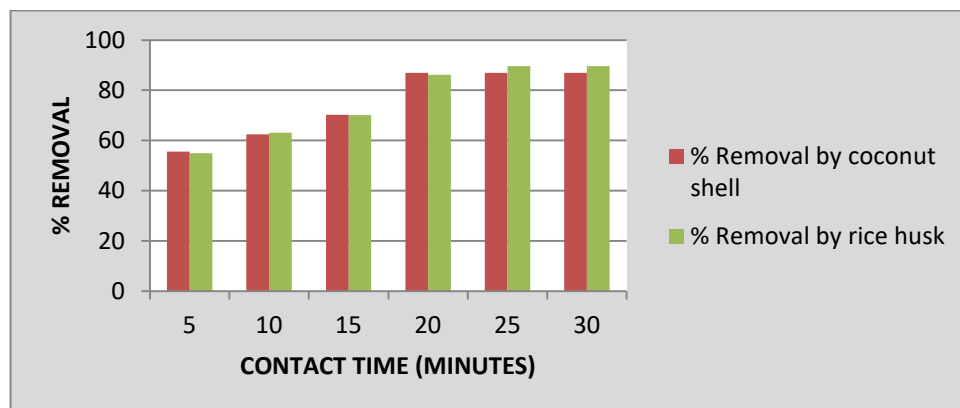


FIGURE-4 EFFECT OF CONTACT TIME

V. CONCLUSION

Low cost adsorbents such as coconut husk and rice husk is effective in removing of lead ions from aqueous solution. The batch method was used; Parameters such as pH, contact time, adsorbent and metal dosage concentration checked. The optimal pH value corresponds to the maximum lead ions removal adsorption is 2 by both bio adsorbent. Both modified bio adsorbent effectively adsorbed lead ions at low initial metal ion concentration. The graph of contact time Vs percentage removal of heavy metal ion concluded that maximum removal of Pb (II) takes place at after 20 and 25 minutes by modified coconut husk and modified rice husk respectively due to time is much needed to reach equilibrium during adsorption process.

REFERENCES

1. Youssef, M., Hagag, A., & Ali, A. H. . Synthesis, characterization and application of composite derived from rice husk ash with aluminium oxide for sorption of uranium. *Adsorption Science and Technology*, 36(5-6), 1274-1293, 2018. <http://dx.doi.org/10.1177/0263617418768920>.
2. Hamid, A., Yaqub, G., Ayub, M., & Naem, M. . Determination of malathion, chlorpyrifos, λ -cyhalothrin and arsenic in rice. *Food Science and Technology*, 41(2), 461-466, 2021. <http://dx.doi.org/10.1590/fst.01020>.
3. Onac, C., Topal, T., & Akdogan, A. Investigation of the nutritional environment of the differences in toxicity levels of some heavy metals and pesticides examined in gilthead bream fishes. *Food Science and Technology*. 2021 In press. <http://dx.doi.org/10.1590/fst.27921>.
4. Singh Sankhla, M., Kumari, M., Nandan, M., & Kumar, R. . Heavy metal contamination in soil and their toxic effect on human health: a review study. *International Journal of All Research Education and Scientific Methods*, 4(10), 13-19, 2016
5. Sheng, J., Zuo, J., Liu, K., Ma, L., Li, C., Li, Y., & Kong, D. . Highly selective enrichment of aflatoxin B1 from edible oil using polydopamine-modified magnetic nanomaterials. *Food Science and Technology*, 41(2), 321-327, 2021. <http://dx.doi.org/10.1590/fst.34619>
6. Tadesse, M., Tsegaye, D., & Girma, G. . Assessment of the level of some physico-chemical parameters and heavy metals of Rebu River in oromia region, Ethiopia. *MOJ Biology and Medicine*, 3(3), 99-118, 2018. <http://dx.doi.org/10.15406/mojbm.2018.03.00085>.
7. Wang, Z., Yang, X., Qin, T., Liang, G., Li, Y., & Xie, X. . Efficient removal of oxytetracycline from aqueous solution by a novel magnetic clay-biochar composite using natural attapulgite and cauliflower leaves. *Environmental Science and Pollution Research International*, 26(8), 7463-7475, 2019 <http://dx.doi.org/10.1007/s11356-019-04172-8>. PMID:30656586.
8. Guo, X., Tang, S., Song, Y., & Nan, J. Adsorptive removal of Ni²⁺ and Cd²⁺ from wastewater using a green longan hull adsorbent. *Adsorption Science and Technology*, 36(1-2), 762-773, 2018. <http://dx.doi.org/10.1177/0263617417722254>.



9. Rangabhashyam, S., & Balasubramanian, P. . The potential of lignocellulosic biomass precursors for biochar production: performance, mechanism and wastewater application: a review. *Industrial Crops and Products*, 128, 405-423, 2019. <http://dx.doi.org/10.1016/j.indcrop.2018.11.041>.
10. P. C. Okafor, P. U. Okon, E. F. Daniel and E. E. Ebenso, : Adsorption Capacity of Coconut (Cocos nucifera L.) Shell for Lead, Copper, Cadmium and Arsenic from Aqueous Solutions, *Int. J. Electrochem. Sci.*, 7, 12354 – 12369, 2012.
11. Wiwid Pranata Putra, Azlan Kamari, Siti Najiah Mohd Yusoff, Che Fauziah Ishak, Azmi Mohamed, Norhayati Hashim, Illyas Md Isa, : Biosorption of Cu(II), Pb(II) and Zn(II) Ions from Aqueous Solutions Using Selected Waste Materials: Adsorption and Characterisation Studies, *Journal of Encapsulation and Adsorption Sciences*, 4, 25-35, 2014.



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details