I J R B A T, Issue (XIII) Volume (III) Sept 2025: 62-66
A Double-Blind Peer Reviewed & Refereed Journal
e-ISSN 2347 – 517X
Original Article

INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE AND TECHNOLOGY

 www.ijrbat.in

ADSORPTION OF Cu(II), Ni(II) and Co(II) ON THE ADSORBENT PREPARED FROM COCONUT SHELL.

M P Patil
*Department of Chemistry, Sevadal Mahila Mahavidyalaya, Nagpur, M.S., India

Communicated: 18.06.2025	Revision: 23.07.2025 & 29.07.2025 Accepted: 17.08.2025	Published: 30.09.2025

ABSTRACT:

Nowadays water is getting contaminated due to discharge of wastewater from different industries in recourses of water without treatment. Due to this pollution in water increases and causing hazardous effects on ecosystem. As the demand of clean water increased various techniques are used for treatment of water such as adsorption, reverse osmosis, coagulation, ion exchange etc. Out of all methods adsorption is the cheaper method for the removal of heavy metals. Activated charcoal was prepared from coconut shells are used as adsorbent for removal of heavy metals like copper, nickel, cobalt. It was observed that the prepared adsorbent was very good for removal of heavy metal.

Keywords:- Adsorption, activated charcoal, coconut peel, absorbance.

INTRODUCTION:

In recent years water pollution is a challenging problem for all living organisms due to untreated discharge of waste water from industries. Waste water contains some organic pollutants like polyatomic hydrocarbons, pesticides, insecticides, chlorinated hydrocarbons while toxic inorganic pollutants include mercury, arsenic, cadmium, and lead.(1,2) Due to this contaminated water with heavy metals aquatic ecosystems and human life is in danger (3). Nowadays many techniques of water treatment are available such as coagulation, floatation, ion exchange, biological treatment and adsorption.(4,5,6) It requires adsorbent. If the adsorbent is prepared from waste material, definitely it will be a cheaper method. Inorganic and organic adsorbents can be used including activated carbon and other carbon based adsorbents such as biochar, zeolite, polymer materials, farming waste, bio-fuels.(7,8) This method also solves the problem of solid waste disposal. The presence of heavy metals ions in water causes toxicity to many life forms. Waste water generally contains the contaminants like heavy metals, pesticides, heavy metals dyes and organic pollutants which causes hazardous effects on human health and ecosystems..(9,10).

EXPERIMENTAL METHOD-

The adsorbents were prepared from lemon peels. The peels were collected washed several times with distilled water and dried in sunlight. The charcoal was prepared by burning and later on activated by using calcium chloride. The solutions Of Cu (II), Ni (II),Co(II) were prepared as 1M, 0.5M, 0.25M, 0.125M, 0.0625M. The absorbance of all solutions were noted at different wavelengths. Later on 0.2 gm charcoal was added to 50 ml solution of heavy metal and was shaken for 30 minutes. After shaking solutions were filtered and absorbance/optical density was recorded at different wavelengths. Same procedure was repeated for all metal ions.

http://doi.org/10.29369/ijrbat.2025.010.3.0008

Table -1: Determination of optical density of Cu (II) solution before and after adsorption on coconut charcoal

Initial Conc.	1M		0.5M		0.25M		0.125M		0.0625M	
Wavelength										
	Before	After	Before	After	Before	After	Before	After	Before	After
400	0.14	0.04	0.09	0.06	0.08	0.05	0.05	0.25	0.04	0.03
420	0.16	0.04	0.11	0.07	0.09	0.05	0.06	0.24	0.05	0.04
480	0.3	0.06	0.25	0.07	0.22	0.06	0.18	0.21	0.05	0.04
500	0.34	0.03	0.3	0.06	0.27	0.04	0.24	0.2	0.05	0.04
520	0.42	0.05	0.37	0.07	0.34	0.05	0.31	0.18	0.05	0.04
540	0.37	0.05	0.33	0.06	0.3	0.05	0.27	0.17	0.04	0.04
620	0.3	0.09	0.22	0.09	0.14	0.06	0.13	0.13	0.04	0.04

Graphs showing optical density of Cu (II) solution before and after adsorption on coconut charcoal

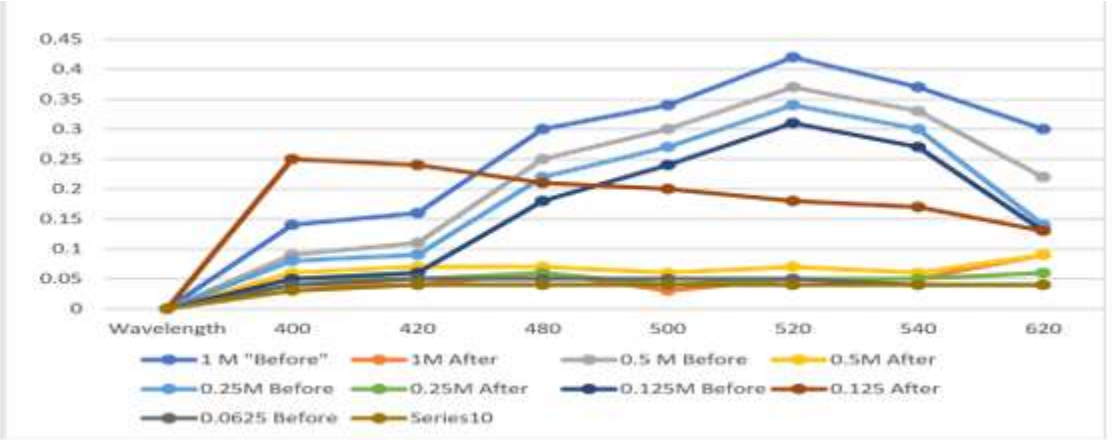


Table -2: For concentration of Cu (II) on coconut Charcoal

Wavelength	1M	0.5M	0.25M	0.125	0.0625M
400	0.28	0.3	0.15	-	0.04
420	0.25	0.31	0.13	-	0.05
480	0.2	0.14	0.06	-	0.05
500	0.08	0.1	0.03		0.05
520	0.11	0.09	0.03	0.07	0.05
540	0.13	0.09	0.04	0.07	0.06
620	0.3	0.2	0.1	.012	0.06

Graph showing concentration of Cu (II) on coconut Charcoal

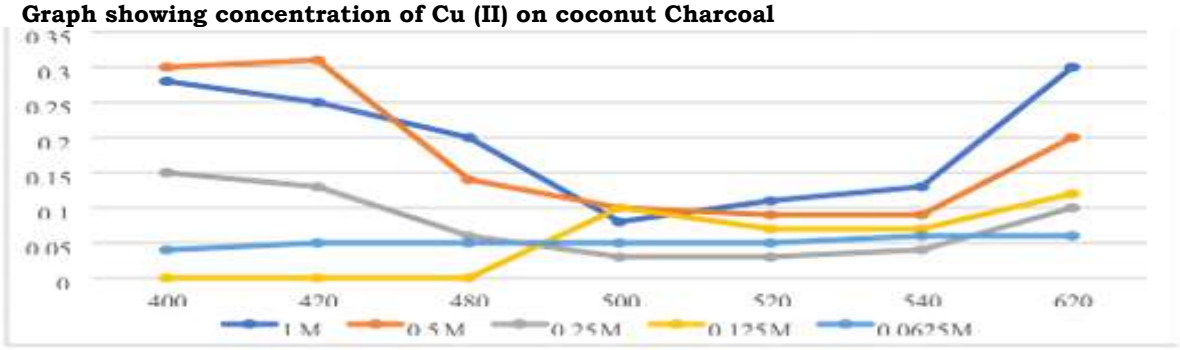


Table 3: Determination of optical density of Ni(II) solution before and after adsorption on coconut charcoal

Initial Conc.	1M		0.5M		0.25M		0.125M		0.0625M	
Wavelength										
	Before	After	Before	After	Before	After	Before	After	Before	After
400	0.34	0.18	0.2	0.13	0.16	0.1	0.11	0.09	0.11	0.07
420	0.34	0.16	0.2	0.14	0.16	0.08	0.12	0.09	0.11	0.08
480	0.25	0.13	.18	0.11	0.16	0.08	0.11	0.08	0.1	0.09
500	0.24	0.11	0.17	0.1	0.15	0.07	0.1	0.08	0.1	0.09
520	0.24	0.09	0.17	0.08	0.14	0.07	0.1	0.08	0.09	0.11
540	0.23	0.9	0.17	0.08	0.12	0.08	0.09	0.08	0.09	0.08
620	0.2	0.12	0.16	0.1	0.12	0.09	0.1	0.08	0.09	0.07

Graphs showing optical density of Ni (II) solution before and after adsorption on coconut charcoal

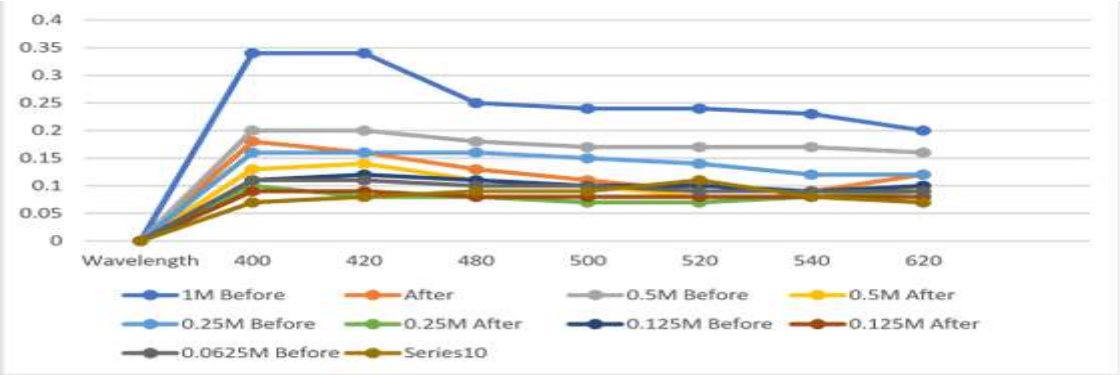


Table -4: For concentration of Ni (II) on coconut Charcoal-

Wavelength	1M	0.5M	0.25M	0.125	0.0625M
400	0.52	0.32	0.15	0.1	0.03
420	0.47	0.35	0.12	0.09	0.04
480	052	0.3	0.12	0.09	0.05
500	0.45	0.29	0.11	0.1	0.05
520	0.37	0.23	0.12	0.1	-
540	0.39	0.23	0.16	0.11	0.06
620	0.6	0.31	0.18	0.1	0.05

Graphs showing concentration of Ni (II) on coconut Charcoal

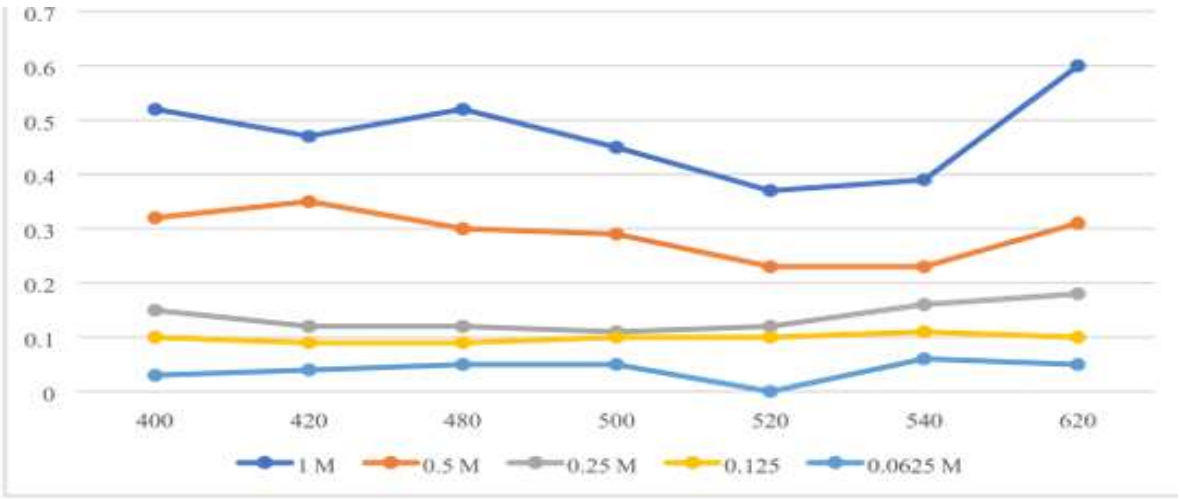


Table 5- Determination of optical density of Co(II) solution before and after adsorption on coconut charcoal

Initial Conc.	1M		0.5M		0.25M		0.125M		0.0625M	
	Before	After	Before	After	Before	After	Before	After	Before	After
400	0.52	0.43	0.22	0.17	0.13	0.1	0.18	0.04	0.09	0.04
420	052	0.43	0.22	0.17	0.14	0	0.11	0.03	0.09	0.03
480	0.65	0.56	0.26	0.22	0.16	0.01	0.12	0.05	0.08	0.03
500	0.67	0.56	0.26	0.22	0.23	0.02	0.08	0.02	0.09	0.02
520	0.74	0.65	0.28	0.22	0.17	0.04	0.12	0.01	0.09	0.01
540	0.72	0.63	0.28	0.23	0.18	0.03	0.12	0.01	0.09	0.01
620	0.33	0.27	0.19	0.12	0.18	0.1	0.08	0.03	0.07	0.08

Graphs showing optical density of Co (II) solution before and after adsorption on coconut charcoal

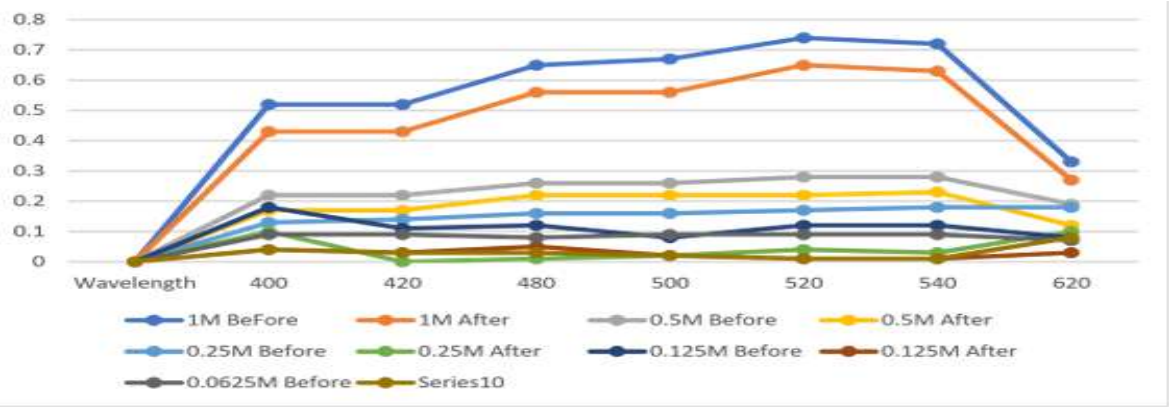
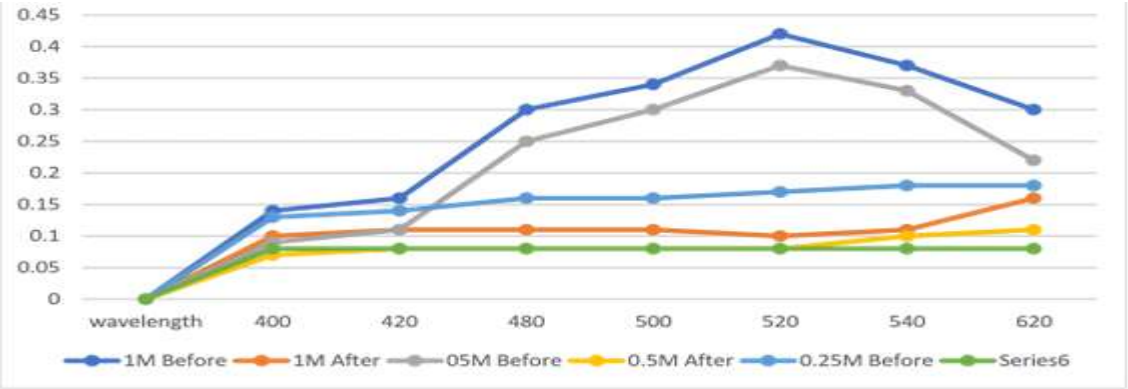


Table -6: For concentration of Co (II) on coconut Charcoal-

Wavelength	1M	0.5M	0.25M	0.125	0.0625M
400	0.82	0.38	0.15	0.19	0.02
420	0.82	0.38	0.12	-	0.02
480	0.86	0.42	0.12	0.01	0.02
500	0.83	0.42	0.11	0.03	0.01
520	0.87	0.39	0.12	0.1	0.0
540	0.87	0.41	0.16	0.01	0.0
620	0.81	0.31	0.18	0.04	0.0

Graph showing concentration of Co (II) on coconut Charcoal -



RESULT AND DISCUSSION –

Adsorption of Cu (II), Ni (II) and Co (II) metal ions were studied on the adsorbent prepared from coconut shell. Solutions of different concentrations were prepared. The optical density was found to decrease in case of Cu (II), Ni (II) and Co (II) solutions. All three metal ion solutions show decrease in concentrations with prepared activated charcoal from coconut shell. Decrease in concentration was found to be more in case of Cu (II) than Ni (II) and Co (II). Hence it was observed that the adsorbent prepared from coconut shells can be used as adsorbent for removal of heavy metal ions.

CONCLUSION –

Adsorption is one of the cheaper methods for removal of heavy metal ions from contaminated water. Various adsorbents are used for removal of heavy metal ions. Many times agricultural waste material is used for the preparation of adsorbent. If such material is used then problem of solid agricultural waste will solved up to some extent. Coconut shells are easily available. We have tried to prepare adsorbent from coconut shell.The adsorbent prepared from coconut shell was used for removal of Cu (II), Ni (II) and Co (II). It was observed that the adsorbent prepared from coconut shell was very good adsorbent for removal of Cu (II), Ni (II) and Co(II) metal ions. Out of three metal ions it removes Cu (II) up to greater extent as compared to Ni (II) and Co(II). Thus instead of wasting coconut shell and throwing anywhere it can be used for the preparation of very good adsorbent.

REFERENCES:

J. Wang, Z. Wang., C.L. Vieira, J.M. Wolfson, G. Pingtian,, S.J. Us Huang. Review on treatment of organic pollutants in water by ultrasonic technology.55 (2019) 273-278.

M. I. Kabir, E Daly. F. J. Sotte Maggi. A review of ion and metal pollutants in urban green water infrastructures.470 (2014) 695-705

Balali Mood, M; Naseri, K; Tahergorbi, Z; Khasdair, M. R. Sadeghi, M. Toxic mechanisms of five heavy metals. Mercury, lead, chromium, cadmium and arsenic Front. Pharmacol 2021, 12 227.[Google Scholar] [CrossRef]

M. Manyangadze, N.H.M. Chikuruwo, T. B.Narsaiah, C. S. Chakra, M. Radhakumari and g. Danha," Enhansing adsorption capacity of of nano-adsorbents via surface modification: A review," South Africa j. Chem.Eng.,vol.31, no. May 2019,pp 25-32, 2020,doi:10,1016/j.sajce.2019.11.003.

Y Tan, M. Chen. And Y. Hao," High efficient removal of Pb(II) by amino-functionalized Fe_3O_4 magnetic nanoparticles." Chem. Eng. J. vol. 191, pp 104-111, 2012, doi:10.1016/j.cej.2012.02.075.

S. Babel and T. A. Kurniwan, "Low cost adsorbents for heavy metals uptake from contaminated water: A review." J. Hazard. Mater., vol.97, no. 1-3,pp 219-243,2003, doi:10.1016/S0304-3894(02)00263-7.

S. Jha.,R. Gaur, S. Shahabuddin Y.J. , I. Tyagi, Biochar as sustainable alternative and green adsorbent for the remediation of noxious pollutants: A Comprehensive review. Toxics,11(2023) p 117

Lau, R.R. Karri, N. M. Mubarak, S. Y. Lau., H. B. Chua, M. Khalid, P. Jagadish, E. C. Avdullah Removal of dye using peroxidase immobilized Bucky paper/polyvinyl alcohol membrane in a multi-stage filtration column via RSM and ANFIS, Environ. Sci. Pollut. Res. 27(2020), pp.40121-40134

Das. T. K., Ghosh S. K., Das N. C. Green synthesis of grapheme oxide/silver nanoparticles-based catalyst for a wide range of organic pollutants. Nano-struct. Nano-Objects. 2023; 34;100960.doi: 10.1016/j.nanoso.2023.100960.

Silvestro I., Fernandez-Garcia M., Ciarlantini C., Francolini I., Girelli A., Piozzi A molecularly imprinted polymers based on chitosan for 2,4 dichlorophenoxyacetic acid removal. Int. J. Mol. Sci. 2022; 23: doi: 10.3390/ijms232113192.