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ADSORPTION OF Co^{+2} AND Cu^{+2} ON THE ADSORBENT PREPARED FROM WASTE PEANUT SHELLS

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ABSTRACT:

The contamination in water due to direct and indirect discharge of many chemicals into water sources without sufficient treatment of harmful chemicals which leads to water pollution is a now a serious problem. Various physicochemical and biological methods have been studied for metal ion removal. Adsorption is the easy and cheaper method for removal of heavy metals. In this study, waste peanut shells were used for the preparation of adsorbent. It was observed that this adsorbent yielded good results.

Key words: Adsorption, peanut shells, Photocalorimetric technique.

INTRODUCTION:

Due to increasing industrialization the disposal of heavy metals into water sources leads to water pollution which is causing hazardous effects on aquatic life. Twenty metals are found to be toxic and half of these metals are risky for human health above certain doses. In recent years the problem treatment processes for the removal of heavy metal ions from waste water include coagulation, carbon adsorption, ion exchange, precipitation; reverse osmosis etc. Adsorption is one of the techniques used for removal of heavy metal ions. Biomaterial which are available in large quantities or certain waste from agricultural operations may have potential that can be used as low cost adsorbents.

Many toxic metals have been discharged to the environment through natural phenomenon and human activities such as industrial waste wastes, agricultural particles transport and waste disposal causes serious water pollution. Heavy metals are well known for toxicity and their disposal is a significant industrial waste problem. Cadmium, Copper, Zinc, Chromium show high toxicity to humans as well as to animals. All these metals are also toxic to plants, being cadmium the strongest phototoxic elements. We have used agro waste material as low-cost adsorbent. The basic components of the agricultural waste materials include hemicelluloses, lignin. Lipids, proteins, simple sugars, water, hydrocarbons and starch containing variety of functional groups. In particular agricultural materials containing cellulose show a potential sorption capacity for various pollutants. If these wastes could be used a low- cost adsorbents, it will provide a two- fold advantage to environmental pollution. Firstly, the volume of waste materials could be partly reduced and secondly the low cost adsorbent, if developed, can reduce the treatment of waste water at reasonable cost. Agricultural activated carbon production due to its low ash content and reasonable hardness. In recent years, development of surface modified activated carbon has generated a diversity of activated carbon with far superior adsorption capacity. In this paper study of adsorbent prepared from peanut shells for heavy metal ions removal was undertaken.

MATERIAL AND METHODS:

Area The waste peels were collected, washed several times with water then dried till the moisture is completely removed. Fine powder was prepared. Activated charcoal from powder of peanut shells was prepared by carbonisation and activation by $CaCl_2$. Photocalorimetric Technique is used for study.

Photocalorimetric Technique

Photocalorimetric Technique is used for determination of colour. The intensity of colour of the substance is directly proportional to its concentration. The solutions of different concentrations were prepared. By adding activated charcoal in a solution of cobalt and copper and shaking for 15 minutes on shaking machine after filtration, optical density and pH of the solution was recorded. Concentration of unknown solution can be determined as follows.

$$\frac{\text{Concentration of solution II}}{\text{Concentration of solution II}} \times \text{Initial concentration of the solution}$$

RESULT AND DISCUSSION:

Study of adsorption of Co^{+2}ions on the activated charcoal shows decrease in the optical density and colour of the solution after adsorption. The pH of the solution changes from 4.77 to 6.46 before adsorption with decreasing concentration of solution.The change in pH after adsorption was found to be changing from 6.04 to 6.83.

In case of Cu^{+2} solution the optical density and colour of the solution was found to be decreased after adsorption. The pH of the solution changes from 5.43 to 6.17 before adsorption with decreasing concentration of solution. After adsorption the change in pH was found to be changing from 5.39 to 6.27. The above observations showed that the adsorbent prepared from peanut shells can act as a good adsorbent for removal of heavy metal ions.

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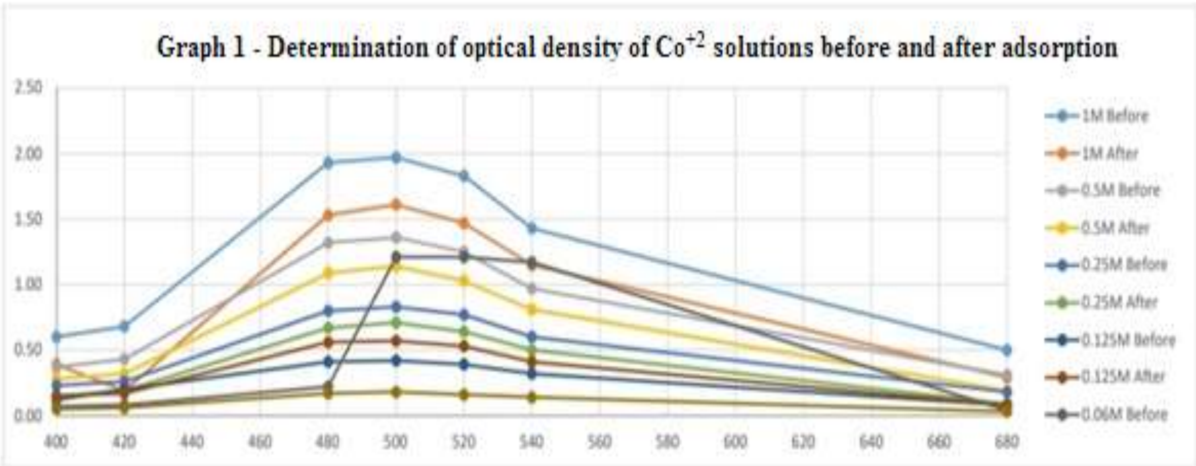
Table 1 - Determination of optical density of Co^{+2} solutions before and after adsorption

Initial conc.	1 M		5×10⁻¹ M		2.5×10⁻¹ M		1.25×10⁻¹ M		0.6×10⁻¹ M	
Wavelength	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
400	0.60	0.39	0.37	0.28	0.23	0.15	0.12	0.15	0.07	0.05
420	0.68	0.19	0.43	0.32	0.26	0.19	0.20	0.17	0.08	0.06
480	1.93	1.53	1.32	1.09	0.80	0.67	0.41	0.56	0.22	0.17
500	1.97	1.61	1.36	1.14	0.83	0.71	0.42	0.57	1.21	0.18
520	1.83	1.47	1.25	1.03	0.77	0.64	0.39	0.53	1.21	0.16
540	1.43	1.15	0.97	0.81	0.60	0.50	0.32	0.41	1.17	0.14
680	0.50	0.29	0.31	0.19	0.18	0.09	0.08	0.08	0.04	0.03
pH	4.77	6.04	5.25	6.33	5.79	6.55	6.08	6.61	6.46	6.83



Graph 1 - Determination of optical density of Co^{+2} solutions before and after adsorption

Table 2- Determination of concentration of Co^{+2} after adsorption

Initial conc.	1 M	5×10⁻¹ M	2.5×10⁻¹ M	1.25×10⁻¹ M	0.6×10⁻¹ M
Wavelength					
400	0.65	0.378	0.163	0.156	0.042
420	0.279	0.372	0.182	0.106	0.045
480	0.792	0.412	0.209	0.170	0.046
500	0.817	0.419	0.213	0.169	0.022
520	0.805	0.412	0.207	0.091	0.045
540	0.625	0.417	0.208	0.010	0.049
pH	6.04	6.33	6.55	6.61	6.83

Graph 2: Determination of concentration of Co^{+2} after adsorption

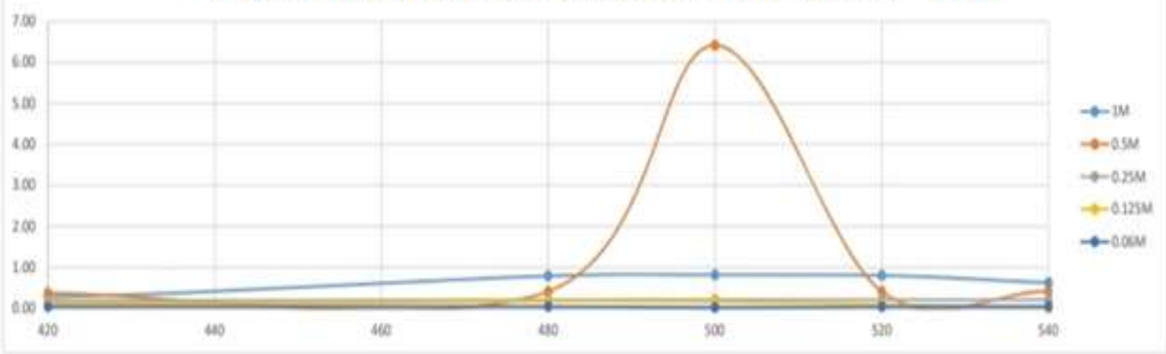


Table 3- Determination of optical density before and after adsorption of Cu^{+2} solution at different wavelengths

Initial conc.	1 M		5×10^{-1} M		2.5×10^{-1} M		1.25×10^{-1} M		0.6×10^{-1} M	
Wavelength	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**	**Before**	**After**
400	0.58	0.45	0.35	0.26	0.18	0.16	0.10	0.05	0.08	0.04
420	0.42	0.32	0.25	0.19	0.13	0.12	0.08	0.05	0.07	0.05
480	0.18	0.04	0.12	0.04	0.07	0.03	0.05	0.2	0.06	0.04
500	0.17	0.03	0.11	0.04	0.06	0.02	0.05	0.03	0.05	0.05
520	0.19	0.05	0.13	0.04	0.07	0.03	0.05	0.03	0.06	0.06
540	0.18	0.07	1.11	0.06	0.06	0.04	0.04	0.03	0.05	0.04
680	0.56	0.46	0.32	0.25	0.16	0.14	0.10	0.06	0.07	0.066
pH	5.43	5.39	5.61	5.46	5.78	5.65	6.00	5.94	6.17	6.27

Graph-3: Determination of optical density before and after adsorption of Cu^{+2} solution

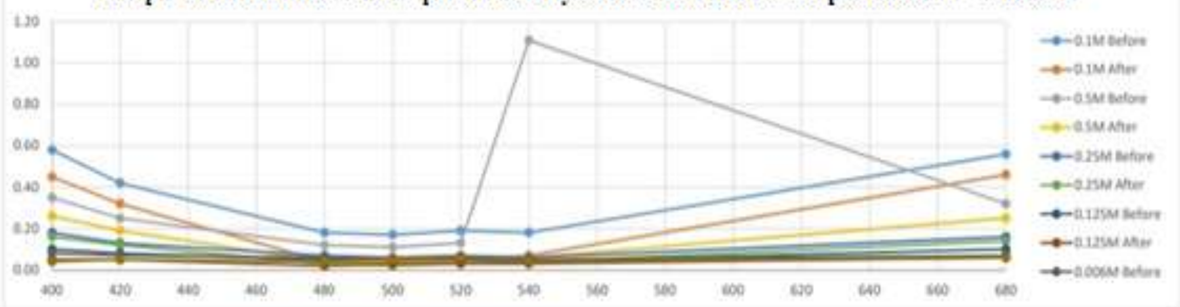
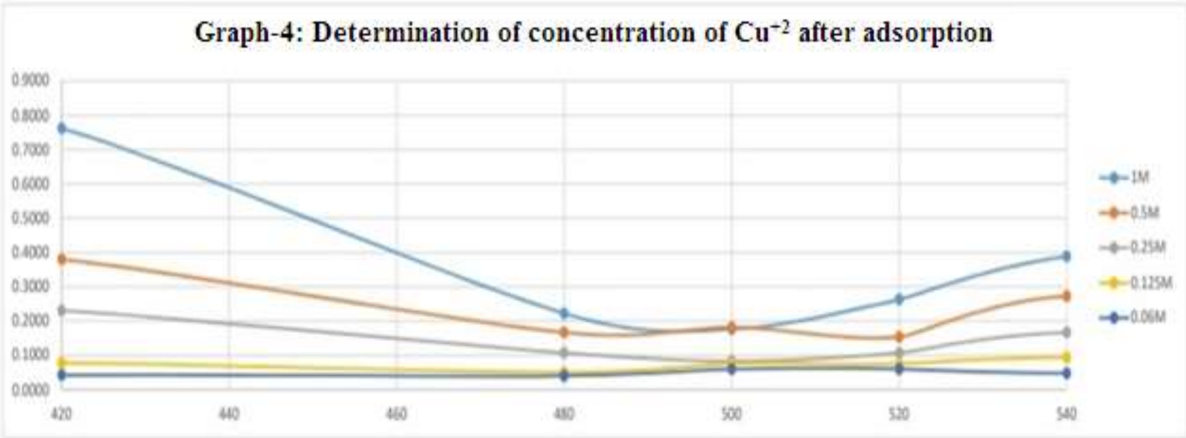


Table 4 - Determination of concentration of Cu^{+2} after adsorption.

Initial conc.	1M	5×10^{-1} M	2.5×10^{-1} M	1.25×10^{-1} M	0.6×10^{-1} M
Wavelength					
400	0.7758	0.3714	0.2222	0.0626	0.03
420	0.7619	0.38	0.2307	0.0781	0.0428
480	0.2222	0.1666	0.1071	0.05	0.04
500	0.1764	0.1818	0.0833	0.075	0.06
520	0.2631	0.1538	0.1071	0.075	0.06
540	0.3888	0.2727	0.1666	0.0937	0.048
680	0.8035	0.3906	0.2187	0.075	0.0514
pH	5.39	5.46	5.65	5.94	6.27


Graph-4: Determination of concentration of Cu+2 after adsorption
0.9000
0.8000
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
420
440
460
480
500
520
540
1M
0.5M
0.25M
0.125M
0.06M