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Comparitive Study of Activated and Nonactivated Adsorbents Prepaired From Waste Material

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Abstract- Photo calorimetric analysis of Cu^{2+} solution was carried . The optical density and pH of the solution before and after adsorption using various activated and non activated powder were recorded, the optical density after adsorption was found to be decreased. The concentration of solution after adsorption process was found to be decreased.

Introduction:

Due to rapid industrialization and urbanization in developing countries like India heavy metal pollution is a serious problem today and its treatment is of special concern due to their recalcitrance and persistence in the environment. Like organic pollutants, most of these heavy metals do not undergo biological degradation, resulting into harmless end products [1]. Many industries, like metal plating, mining operations, tanneries, radiator manufacturing, smelting, alloy industries and storage batteries industries, etc. release these severely toxic heavy metal ions in their wastewaters contaminating natural streams where in disposed, which is a major concern due to toxicity to many life forms [2].Though there are many treatment methods for removal of heavy metals from wastewater like chemical precipitation, membrane filtration, ion exchange, coagulation and flocculation, floatation, electrochemical treatment, adsorption and co-precipitation followed by adsorption etc. yet various researchers have studied and revealed that physical adsorption is a highly effective and economic technique for the removal of heavy metal from waste stream and from ancient times activated carbon has extensively been used as an adsorbent [3] in the water and wastewater treatment plants, but it is found to be an expensive material. Recently, an idea of the production of safe and low cost alternatives to this expensive and commercially available activated carbon has attracted the researchers towards the low cost agro and horticultural wastes and by-productsfor the removal of heavy metals from wastewater and it has been investigated successfully [4, 5].

1.1 Heavy Metals:-

Heavy metals are member ofa loosely-defined subset of elements that exhibit metallic properties, has high density, which mainlyincludes the transition metals, some metalloids, lanthanides, and actinides. Certain heavy metals such as iron, copper (Cu), zinc and manganese arerequired by humans for normal biological functioning. However, heavy metalssuch as mercury, lead, cadmium are toxic to organisms. Most of the healthdisorders are linked with specific tendency of heavy metals to bio accumulate inliving tissues and their disruptive integration into normal biochemical processes [6].

1.2 Effects of heavy metals:-

Increased use of metals and chemicals in processindustries has resulted in generation of large quantities of effluent that containshigh level of toxic heavy metals and their presence poses environmental-disposalproblems due to their non-degradable and persistence nature[7]. The soluble form of metals is moredangerous because it is easily transported, hence more readily available to plantsand animals. Metal behavior in the aquatic environment is surprisingly similar tothat outside a water body. Sediments at the bed of streams, lakes and rivers exhibitthe same binding characteristics as soil particles mentioned earlier. Hence, many of these heavy metals will dissolve. The aquatic environment is more susceptible tothe harmful effects of heavy metal pollution. Metal ions in the environmentbio accumulate and are biomagnified along the food chain. Their toxic effectis more pronounced in animals at higher trophic levels [7]. Heavy metals tend to be sequestered at the bottom of water bodies. Removal of heavy metals from industrial wastewater is of primaryimportance because they are not only causing contamination of water bodies and are also toxic to many life form [8].

Heavy metals in industrial wastewater include lead, chromium,mercury, uranium, selenium, zinc, arsenic, cadmium, silver, gold, and nickel (Ahalyaet al., 2003). The main threats to human health from heavy metals are associated withexposure to lead, cadmium, mercury and arsenic. These metals have been extensivelystudied and their effects on human health regularly reviewed by international bodiessuch as the WHO. Acute heavy metal intoxications may damage central nervousfunction, the cardiovascular and gastrointestinal (GI) systems, lungs, kidneys, liver,endocrine glands, and bones. Chronic heavy metal exposure has been implicated inseveral degenerative diseases of these same systems and may increase the risk of somecancers.[9,10]

Several techniques such aschemical precipitation, oxidation, reduction, coagulation, solvent extraction, ionexchange, filtration, electrochemical treatment, reverse osmosis, membranetechnologies, evaporation recovery, and adsorption have been commonlyemployed for the removal of metal ions [11].

Effects of Cu^{2+} :- Workers involved in spraying of Bordeaux mixture (an insecticide with Cu) on grapes, other crops develop acute irritation of respiratory tract and metal fume fever characterized by the development of interstitial pulmonary lesions and nodular fibro hyaline scars containing deposits if copper. Lung cancer may also develop in many cases. An injection of about 50-80 mg of copper causes gastro-intestinal disturbances, nausea, vomiting etc. larger quantities taken accidently or intentionally may cause hemolysis hepatotoxic and nephrotoxic of effects. A higher concentration of copper is injurious to blue green algae since this metal tend to suppress nitrogen fixation.

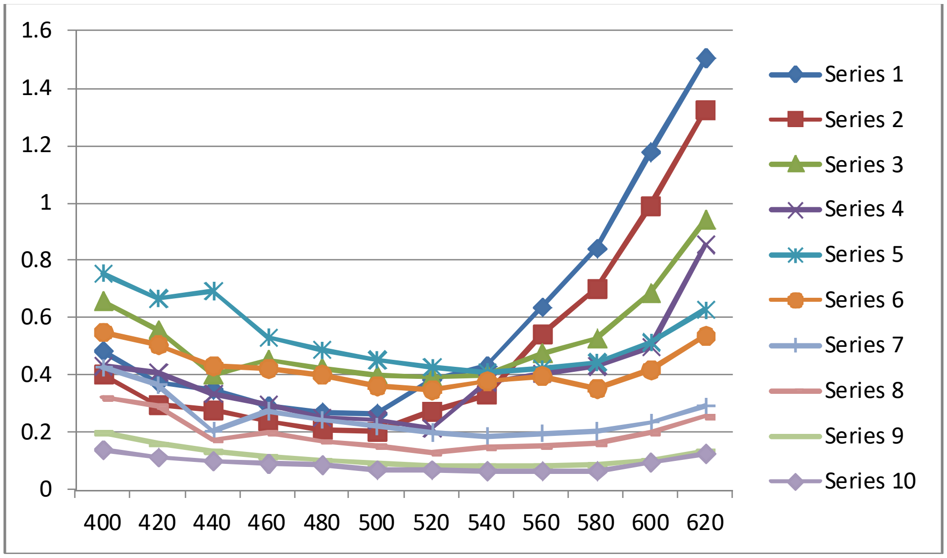
Bottle No.	Wt. of Water	Acid+ Water	Vol. of NaOH before Adsorption For 10ml (A)	Vol. of NaOH After Adsorption For 10ml (C)	Amount of acid Adsorbed In Terms of NaOH (H)=A-C	X/m	LogX/m	logC	1/X/m	1/C
1	1gm	50+0	20	9.3	10.7	10.7	1.0293	0.9684	0.0934	0.1075
2	1gm	40+10	16	12.5	3.5	3.5	0.5440	1.0969	0.2285	0.0800
3	1gm	30+20	12	8.3	3.7	3.7	0.5682	0.9190	0.2702	0.1204
4	1gm	20+30	8	7.8	0.2	0.2	0.698	0.8920	0.5000	0.1282
5	1gm	10+40	4	1.6	2.4	2.4	0.3802	0.2041	0.3166	0.625
6	1gm	5+45	2	0.3	1.7	1.7	0.2304	-0.5228	0.5228	3.333

Observation table of adsorption isotherm for tuvar legumes peel

Observation table 1 :- Adsorption of Cu^{2+} on tuvar legume peels nonactivated powder -

Initial con.	**1 M**		**0.5 M**		**0.25 M**		**0.125 M**		**0.0625 M**	
wavelength	**before**	**after**	**before**	**after**	**before**	**After**	**before**	**after**	**before**	**after**
400	0.483	0.400	0.657	0.431	0.755	0.549	0.429	0.322	0.200	0.138
420	0.374	0.297	0.559	0.409	0.665	0.507	0.365	0.290	0.163	0.114
440	0.347	0.279	0.403	0.337	0.695	0.431	0.205	0.176	0.135	0.099
460	0.294	0.238	0.453	0.298	0.530	0.421	0.273	0.200	0.116	0.090
480	0.271	0.208	0.424	0.253	0.490	0.400	0.244	0.170	0.105	0.086
500	0.265	0.205	0.400	0.246	0.455	0.361	0.221	0.153	0.093	0.071
520	0.383	0.276	0.393	0.215	0.426	0.350	0.199	0.130	0.085	0.069
540	0.433	0.333	0.403	0.375	0.408	0.381	0.186	0.150	0.083	0.064
560	0.636	0.541	0.477	0.404	0.423	0.396	0.194	0.153	0.085	0.065
580	0.843	0.700	0.528	0.430	0.446	0.355	0.203	0.163	0.088	0.067
600	1.175	0.989	0.684	0.499	0.515	0.417	0.235	0.201	0.103	0.094
620	1.505	1.325	0.941	0.853	0.627	0.538	0.290	0.259	0.136	0.128
pH	2.3	3.5	2.5	3.9	2.7	4.3	3.2	4.6	3.5	4.9

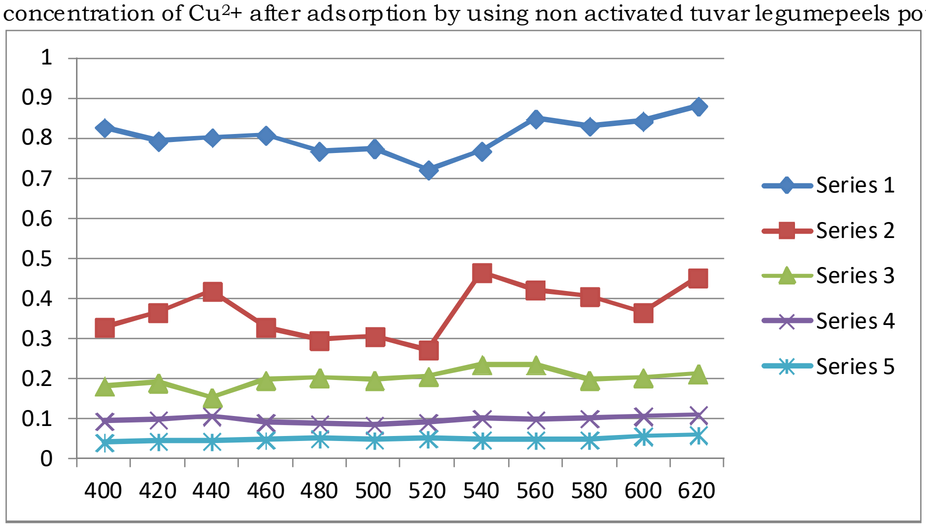
Graph of optical density of Cu^{2+} after and before adsorption on tuar legume non activated powder verses wavelength



Observation table 2 :- Determination of concentration of Cu^{2+} after adsorption by using tuvar legume peels powder -

Initial conc	1M	0.5 M	0.25 M	0.125 M	0.0625 M
wavelength					
400	0.828157	0.328006	0.181788	0.093823	0.043125
420	0.794118	0.365832	0.190602	0.099315	0.043712
440	0.804035	0.418114	0.155036	0.107317	0.045833
460	0.809524	0.328918	0.198585	0.091575	0.048491
480	0.767528	0.298349	0.204082	0.08709	0.05119
500	0.773585	0.3075	0.198352	0.086538	0.047715
520	0.720627	0.273537	0.205399	0.081658	0.050735
540	0.769053	0.465261	0.233456	0.100806	0.048193
560	0.850629	0.42348	0.234043	0.098582	0.047794
580	0.830368	0.407197	0.198991	0.100369	0.047585
600	0.841702	0.364766	0.202427	0.106915	0.057039
620	0.880399	0.453241	0.214514	0.111638	0.058824
pH	3.5	3.9	4.3	4.6	4.9

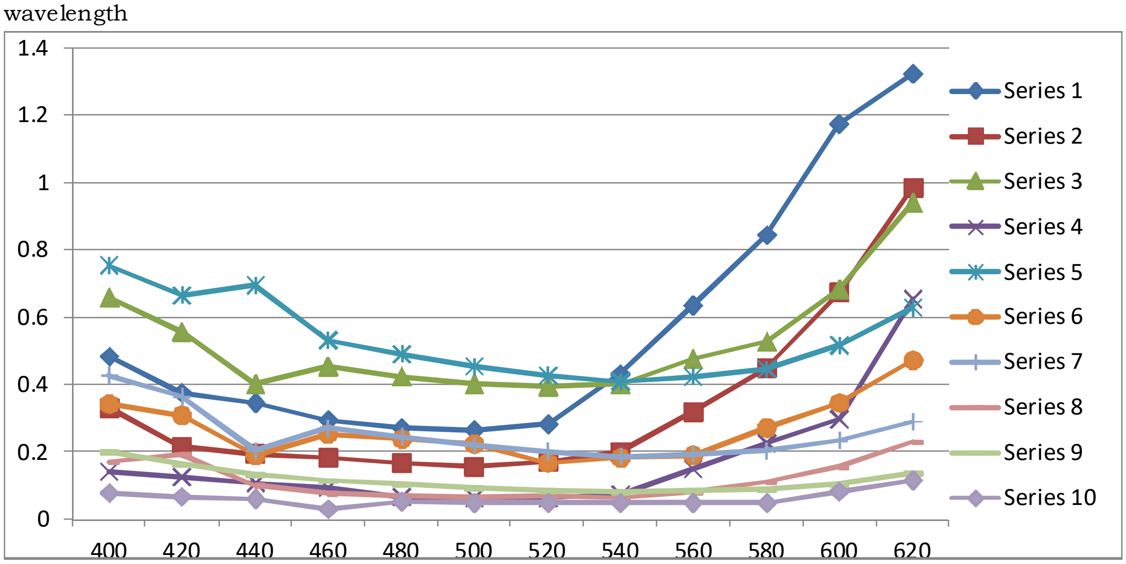
Graph of concentration of Cu^{2+} after adsorption by using non activated tuvar legumepeels powder



Observation table 3 :- Adsorption of Cu^{2+} on tuvar legume activated charcoal

Initial con.	**1 M**		**0.5 M**		**0.25 M**		**0.125 M**		**0.0625 M**	
wavelength	**before**	**after**	**before**	**after**	**before**	**After**	**before**	**after**	**before**	**after**
400	0.483	0.331	0.657	0.141	0.755	0.343	0.429	0.170	0.200	0.078
420	0.374	0.217	0.559	0.125	0.665	0.309	0.365	0.195	0.163	0.067
440	0.347	0.195	0.403	0.109	0.695	0.189	0.205	0.100	0.135	0.059
460	0.294	0.182	0.453	0.092	0.530	0.254	0.273	0.077	0.116	0.031
480	0.271	0.169	0.424	0.067	0.490	0.237	0.244	0.070	0.105	0.052
500	0.265	0.158	0.400	0.062	0.455	0.223	0.221	0.067	0.093	0.049
520	0.383	0.172	0.393	0.062	0.426	0.166	0.199	0.069	0.085	0.047
540	0.433	0.201	0.403	0.075	0.408	0.182	0.186	0.065	0.083	0.047
560	0.636	0.318	0.477	0.148	0.423	0.189	0.194	0.081	0.085	0.048
580	0.843	0.451	0.528	0.225	0.446	0.273	0.203	0.111	0.088	0.050
600	1.175	0.671	0.684	0.298	0.515	0.346	0.235	0.155	0.103	0.083
620	1.505	0.986	0.941	0.653	0.627	0.472	0.290	0.230	0.136	0.115
pH	2.3	4.4	2.5	4.9	2.7	5.3	3.2	5.7	3.5	6.0

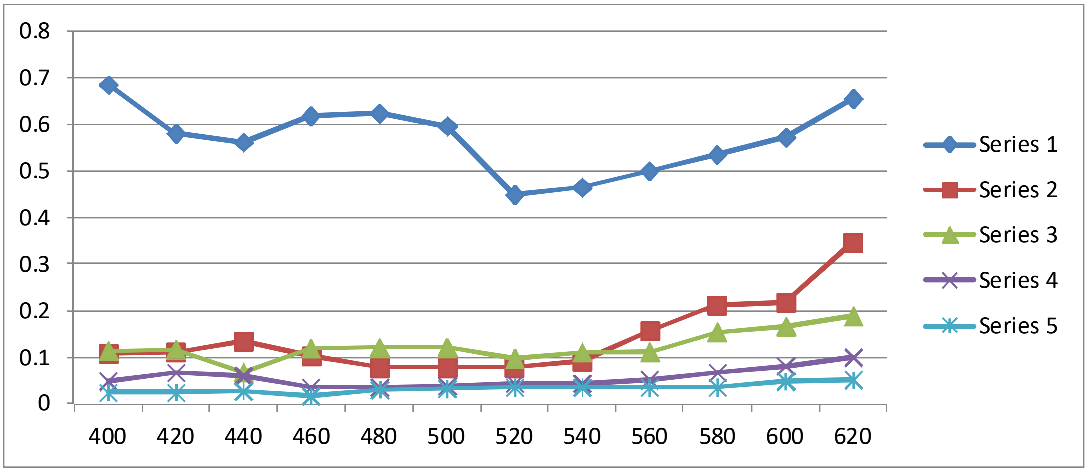
Graph of optical density of Cu^{2+} after and before adsorption on tuvar legume activated charcoal verses wavelength



Observation table 4:-Determination of concentration of Cu^{2+} after adsorption by using tuar peels Charcoal

Initial conc.	1 M	0.5 M	0.25 M	0.125 M	0.0625 M
wavelength					
400	0.6853	0.107306	0.113576	0.049534	0.024375
420	0.580214	0.111807	0.116165	0.066781	0.02569
440	0.56196	0.135236	0.067986	0.060976	0.027315
460	0.619048	0.101545	0.119811	0.035256	0.016703
480	0.623616	0.079009	0.120918	0.035861	0.030952
500	0.596226	0.0775	0.122527	0.037896	0.03293
520	0.449086	0.07888	0.097418	0.043342	0.034559
540	0.464203	0.093052	0.11152	0.043683	0.035392
560	0.5	0.155136	0.111702	0.052191	0.035294
580	0.534994	0.213068	0.153027	0.06835	0.035511
600	0.571064	0.217836	0.167961	0.082447	0.050364
620	0.65515	0.346971	0.188198	0.099138	0.052849
pH	4.4	4.9	5.3	5.7	6.0

Graph of wavelength versesconcentration of Cu^{2+} after adsorption by using tuar peels Charcoal



Graph:- After adsorption of Cu^{2+} using activated tuar legumes peels charcoal

Result and Discussion -

Photo calorimetric analysis of Cu^{2+} solution was carried out. The optical density and pH of the solution before and after adsorption using various activated and non activated powder were recorded, the optical density after adsorption was found to be decreased. The concentration of solution after adsorption process was found to be decreased. In case of tuvar legumes peels the concentration of Cu^{2+} is found to be decreased after adsorption. The concentration of Cu^{2+} is found to be more decreased in case of activated charcoal than in non activated powder. Graphs were plotted by taking wavelength along x-axis and optical density along y-axis indicating the changes in O. D. before and after adsorption. The wavelength verses concentration graph were also plotted showing decrease in concentration of solution. The metal solution shows decrease in concentration graphically.

The comparative study of non activated and activated charcoals prepared from waste material shows that the adsorption of heavy metals takes place in case of non activated charcoal also. The adsorption of these powders obtained from waste material .the most important benefit of this work is that the powders i. e. non activated charcoal can also be used as an adsorbent.

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