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Removal of copper from aqueous solution using low cost biosorbent (Potato Peel)

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Abstract
Literature review shows that excess concentration of copper cause various diseases and also harmful for water species life. Different conventional remedies are available besides all these; adsorption method is very cheap and cost effective. Main purpose of this study is to check the efficiency of potato peels waste as a low cost adsorbent. Copper adsorption onto potato peel powder was studied with different parameters such as pH, contact time, adsorbent doses and pollutant concentration. Result shows that maximum percent of copper removal was 76.50% at pH 6 with 10 ppm metal concentration and 5.0 gm adsorbent dose at ambient temperature.

Keywords: Potato peel waste, aqueous solution, copper ion, biosorbent, adsorption process

1. Introduction
Heavy metals contamination of water is a serious threat to the globe ecosystem. Many industries such as metal plating, mining operation, and tanneries release wastewaters contaminated with heavy metals into the environment [1]. It is well known that some metals can have poisonous or otherwise toxic to human beings and ecological environments, include chromium, antimony, copper, lead, mercury, cadmium, manganese etc [2]. Among the heavy metals, copper is the major available type of heavy metal in the aquatic environment. Copper in the blood system may generate reactive free oxygen species and damage the protein, lipids and DNA. The excess copper compound in the body may also affects on aging, schizophrenia, mental illness, Indian childhood cirrhosis, Wilson's and Alzheimer's diseases. Copper has damaged the marine ecosystem and damaged the gills, liver, kidneys, the nervous system and changing sexual life of fishes [3]. Many methods have been undertaken in the process to remove these unwanted contaminants such as physio-chemical methods, various biological methods and to large extent nano based techniques [4]. The sustainable removal of heavy metals from water and wastewater has become a major challenge for scientists. Beside this available method for copper removal [3]. Biosorption is potentially an attractive technology for treatment of waste water for retaining heavy metal form dilute solution. Biosorption has been suggested as cheaper, more effective and minimization of chemical and biological sludge. There are many natural bisorbent are present in our environment which have the capacity to remove heavy metal from waste water [5].

2. Materials Methodology
2.1 Collection and Preparation of adsorbent
Potato peels referred as biosorbent, were collected from a local food chain free of cost and washed several times with normal tap water and left over night to remove water and then rinsed in.1 M HCL. And washed with distill water repeatedly to remove free acid. Biosorbend residue was dried first in air and then finally in oven at (103-110 ^{o}C) [6] and powdered using electric grinder. The homogeneous powder was passed through mesh for desire particle size then stored in air tight plastic bottle to further use.

Fig 1: Prepared potato peel powder

2.2 Preparation of stock solution of copper

A stock solution of (1000 mg/L) copper was prepared by dissolving 3.981g of hydrated copper sulfate ($CuSO_4.5H_2O$) in 1000 ml of distilled water. And further standard solution of desired concentration was prepared from stock solution. All glassware was cleaned with distilled water.

2.3 Batch adsorption procedure

Experimental study was done in four different batches and each batch had four samples of test (100ml) solution of different known copper concentrations (10, 20 30 and 40 mg/L) and known weight of adsorbent dose (0.5, 1, 1.5 and 2 gm) was used with predetermined time interval (10, 20, 30, 40, 50 and 60 min) at ambient temperature. The pH of the test solution was adjusted manually by adding 0.1 M HCL and 0.1 M NAOH.

Thereafter each experimental sample prepared with desired copper concentration with weighted adsorbent dose added / take place in 100ml of volumetric flask and filled up to the mark with distilled water. Then test mixture set to the shaken in shaker machine. Same procedure was applied to the other batches. After the desired time interval the suspension of the adsorbent with the solution was separated from the solution by filtration using whatman no.42 filter paper. Observation of absorbed metal ion was analyzed by atomic absorption spectrophotometer.

In each batches the effect of adsorbent dose, contact time, pH and ion concentration on adsorption were studied. And the optimum condition of all these parameters was observed. Heavy metal removal percentage was determined using following Equation:-

Metal ion removal (%) = $[(Co - Ce) / Co] \times 100$ ……(1)

Where

Co: initial metal ion concentration of test solution, mg/l.

Ce: final equilibrium concentration of test solution, mg/l.

3. Results & Discussion

3.1 Effect of initial copper concentration on adsorption process

Figure shows the effects of different initial concentration of copper on adsorption process by the bioadsorbent. It could observe that higher uptake of copper metal ion (87.50%) at (10 mg/L) initial concentration of copper for constant time and dose. At initial stage there were sufficient exchangeable sites available between adsorbent and adsorb ate so higher uptake of Cu was obtained. And other hand, after rising in Cu concentration more competition arise between (adsorb ate) ion and adsorbent, that may be responsible for the lower removal percent.

Table 1: Data on initial metal concentration and removal percentage.

Sr. no.	Initial concentrations of Copper mg/L	% Removal
1.	10	87.50
2.	20	85.20
3.	30	82.00
4.	40	70.00

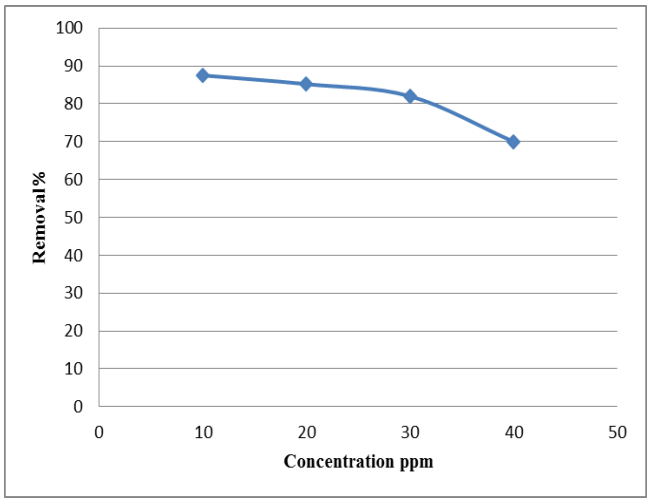

Fig 2: Effect of initial ion concentration on adsorption of copper

3.2 Effect of adsorbent dose on adsorption process

It is important parameter to affect the efficiency of copper removal. It observed that optimum removal percentage was obtained at 2.0 gm adsorbent dose which was (78%). In the starting stage of adsorption numbers of exchangeable or unsaturated sites were available between biosorbent and metal ions. Further rise in surface area of the adsorbent with respect to copper concentration no further improvement achieved. And copper precipitation begins because greater availability of adsorbent and lower availability of Cu ions.

Table 2: Data on adsorbent dose and removal percentage

Sr. no.	Adsorbent doses (gm)	% Removal
1.	0.5	59.20
2.	1.0	68.72
3.	1.5	78.00
4.	2.0	78.00

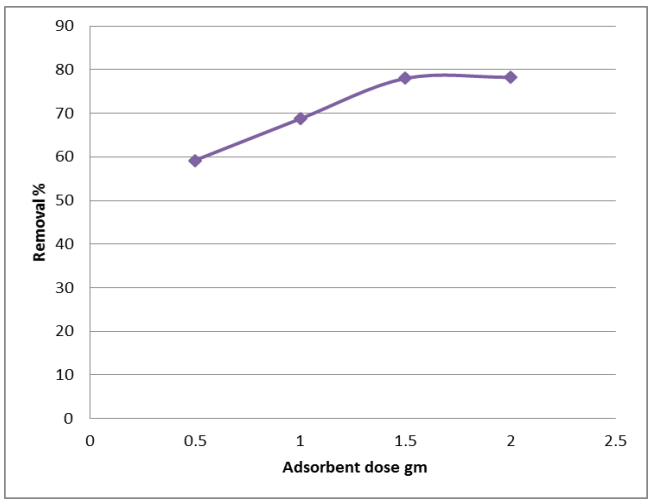

Fig 3: Effect of adsorbent dose on adsorption of copper

3.3 Effect of contact time on adsorption process

Figure shows that the removal percentage of copper increased with increase in contact time. Contact time parameter studied Between 10 to 60 minute at 0.5 gm biosorbent. Slowly improve in contact time up to 40 minute, removal percentage increased. The maximum removal around 75.50% occurs at 40 minute. Then after further improve in contact time there were no change. Saturation of copper obtained due to precipitation occurs between metal ion and adsorbent.

Table 3: Data on contact time and removal percentage.

Sr. no.	Time (min.)	% Removal
1.	10	60.20
2.	20	65.10
3.	30	70.00
4.	40	75.50
5.	50	73.40
6.	60	71.30

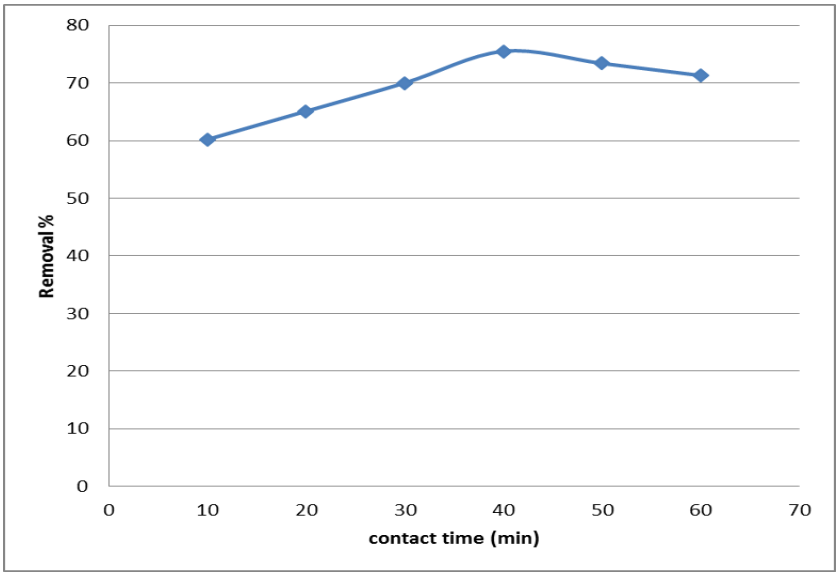

Fig 4: Effect of contact time on adsorption of copper

3.4 Effect of pH values on adsorption process

Figure shows the different effects of pH on adsorption process.it could observe that the removal percentage was very low at acidic condition. At pH=3 the removal percentage (63.50%) of Cu. After at pH=4 Cu was 69.00% further rising in pH value the maximum adsorption (76.50%) was obtained at pH 6. Then removal value of copper stay constant at pH>6 this was due to, metal ions are more soluble at lower pH value and this enhances their adsorption as observed [7]. Removal of metal ions at higher pH values could be attributed to the formation of their hydroxides which results in precipitates as observed [7].

Table 4: Data on pH value and removal percentage.

Sr. No.	pH	% Removal
1.	3	63.50
2.	4	69.00
3.	5	72.50
4.	6	76.50
5.	8	74.00
6.	9	73.45

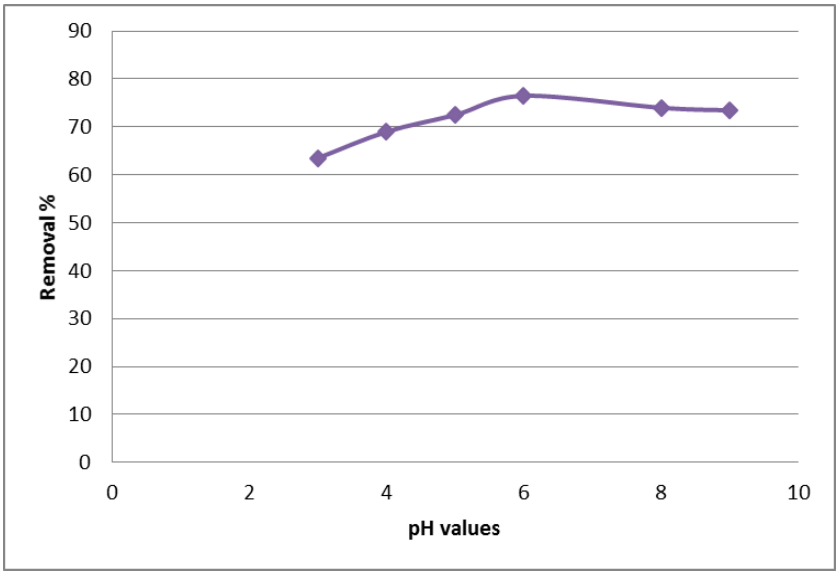

Fig 5: Effect of pH on adsorption of copper

4. Conclusion

The result of this research shows that potato peel waste powder can be used as good alternative to treat copper from aqueous solution. Different optimum conditions were studied like 40 minutes contact time, 2.0 gm adsorbent dose, 6 pH and 10ppm initial copper concentration. Maximum (87.50%) removal of copper was found at initial 10 ppm concentration from aqueous solution. It could be concluded that potato peel waste is an excellent biosorbent alternative to reduce copper ion from water at domestic level as well as industrial level.

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6. References

1. Kyzas GZ, Bikiaris DN, Kostoglou M, Lazaridis NK. Copper removal from aqueous systems with coffee wastes as low cost materials. E3S Web of Conferences. 2013; 1:25004-5,
2. Ahsan Habib, Nazrul Islam, Anarul Islam, Shafiqul Alam AM. Removal of copper from aqueous solution using orange peel, sawdust and bagasse. Pak. J Anal. Environ. Chemical. 2007; 8(1, 2):21-25.
3. Hossain MA, Hao Ngo H, Guo WS, Nguyen TV. Removal of copper from water by adsorption onto banana peel as bioadsorbent. International J of Geomate. 2012; 2(4):227-234,
4. Mrinalini Kanyal, Anuja Ashok Bhatt. Removal of Heavy Metals from water (Cu and Pb) Using Household Waste as an Adsorbent". Kanyal and Bhatt, J Bioremed Biodeg. 2015; 6(1):2-6,
5. Mayur A. Chavan, Sachin Mane. Removal of Copper and Zinc from Aqueous Solutions by using low cost Adsorbents. International journal of science and research (IJSR). 2013; 4(7):3078-80.
6. Farai Mutongo Olga Kuipa, Pardon K Kuipa. Removal of Cr (VI) from aqueous solutions using powder of potato peelings as a low cost sorbent. Hindawi Publishing Corporation Bioinorganic Chemistry and Applications. 2014, 1-7.
7. Oyedeji O Abdulrasaq, Osinfade G Basiru. Removal of copper iron and lead ions from mono component simulated waste effluent by adsorption on coconut husk. African Journal of Environmental Science and Technology. 2010; 4(6):382-387.