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COPPER REMOVAL FROM WASTEWATER BY ORANGE PEEL

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ABSTRACT

"When there is a choice of Smart, why to choose only Better." Environmental pollution by toxic heavy metal contamination due to rapid industrialization is a challenging problem for maintaining the quality and hygiene of water. The discharges of industrial effluents into aquatic environment cause a potential threat to the aquatic life as well as human health, which is a matter of great concern due to their toxic nature and adverse effect. Techniques used to remove heavy metal are namely physical, chemical and biological, Adsorption treatment. Biosorption is a recent eco-friendly technique which gained importance in this decade. The process of Biosorption has many attractive features compared to the conventional method. The present study investigates that successful use of eco-friendly adsorbents orange peels. orange peels which are discarded as fruit waste and are available as waste in the market were used to prepare environment gentle bio adsorbent for the adsorption of heavy metals from aqueous solution. Fruit peels were washed and dried, before being used for the treatment of industrial wastewater. Mainly different heavy metals solutions were prepared to test whether the fruit peels absorb toxic metals are not. It is found that the maximum efficiency of removal of heavy metal is 75% and 80% respectively.

We thought of minimizing a load of heavy metals present in the water by using effective and cost cutting method. Fruits are rich in giving required vitamins to our body but are they good in removing heavy metals from our wastewater.

Keywords: Wastewater, Orange fruit peels, Bio sorption, Eco-friendly, Adsorbents, Cu (II) ion, Removal efficiency

I. INTRODUCTION

India is currently suffering from the worst water crises in history. Water is the vital resource,necessary for all aspects of human and ecosystem survival and health. These days, water pollution by dyes, pesticides and heavy metals in particular is an environmental tragedy. Removal of toxic metals from wastewater is a matter of great interest in the field of water pollution, which is a serious cause of water quality degradation.

Heavy metals like copper, zinc, cadmium, cobalt, nickel is particularly dangerous because they are non-biodegradable, toxic even at lower concentrations, and they can-accumulate in the human body. In recent years, there has been an increasing ecological and global publichealth concern associated with environmental contamination by heavy metals. The exposureto humans has risen dramatically as a result of an exponential increase in use of heavy metals in various fields including industrial, domestic, agricultural applications, etc.

Increase in the industrial activities has caused many surface waters to receive loads of heavymetals that exceed the maximum permissible limit for any type of wastewater discharge which is set to protect the environment, people and animals.

The exponential increase in the use of the heavy metals over the past few years has unavoidably resulted in an increased inflow of metallic substances in the aquatic environment. At least 20 metals are classified as toxic, and most of which are emitted into the environment in quantities that leads to poor human health.

Among the naturally occurring elements heavy metals have a high atomic weight and densityat least 5 times greater than water. Industrial, domestic, agricultural, medical and technological applications have led to their wide distribution in the

environment; raising concerns over their potential effects on human health and the environment. Toxicity of heavy metals depends on several factors including the dosage, type of exposure, and chemical species, as well as the age, gender, genetics, and nutritional status of exposed individuals. Health conditions that may not be immediately recognized as due to heavy metal toxicity:

- Nausea
- Vomiting
- Diarrhea
- Abdominal pain
- Central nervous system dysfunction
- Heart problems
- Anemia

Pollutants are being added to the ground water system through human and natural processes. Industrial units dump their solid waste near the factories, which react with percolating rainwater and ultimately reaches the ground water. Many lands based, water- based activities and over exploitation are causing contamination of aquifers leading to unsafeground water. In areas of high population density and intensive human use of the land, ground water becomes especially vulnerable. The industrial activities where chemicals or wastes may release to the environment in any form, whether intentionally or accidentally, has the potential to pollute ground water Other activities of industries like metal smelting, combustion of fossil fuels, agricultural pesticide production in the estate can groundwater with arsenic. Chronic exposure to arsenic can cause harm to the cardiovascular, skin, gastrointestinal, hepatic, neurological, pulmonary, renal and respiratory systems, reproductive system.

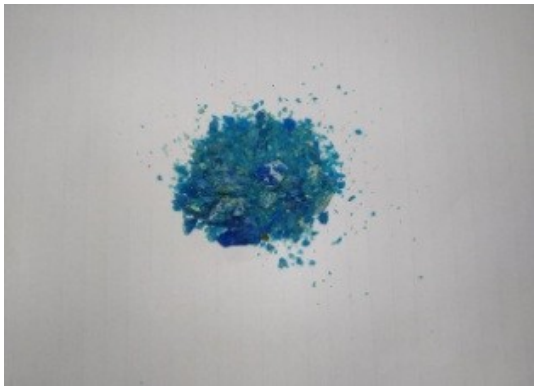
II. METHODOLOGY

"Adsorption is basically a mass transfer process by which a substance is transferred from the liquid phase to the surface of a solid, and becomes bound by physical and or chemical interactions."

6.4 Preparation of stock solution

The solution was self-contaminated. to prepare a 1000 ppm of stock solution of copper, we added a 3.93 g powder of copper sulphate in 1L of deionized water. from stock solution we prepared a 5-ppm concentration of heavy metal contaminated water. for preparation of 5 ppm solution we took 20 ml from 1000 ppm solution in a beaker & add deionized water up to 250 ml.

#Step 1 - Copper Sulfate



#Step 2 – Stock solution

6.5 Preparation of Orange peel powder (OPP)

We collected orange peels from various juice centers. The fruits were first peeled off to obtain the outer skin of the fruits the peel was washed with distilled water to remove possible foreign materials present (dirt and sands). The peels were washed several times with distilled water. We dried them 1st in sunlight for and then in an oven at 80 ºC for 24hrs. The orange peels were later cut into small pieces and half of the peels were converted into powder form. The dried peels were grinded in a mixer grinder and then sieved between 75µ to 150µ sieve size. 500 grams of dried orange peels were taken and grinded. The final weight of orange peel powder thus obtained was 326 grams. The powdered material was stockpiled in air tight container to be utilized in the future without any further treatment.

#Step 1 - Collected Orange Peel from various juice centers

#Step 2 – Dried Orange Peel

#Step 3 - Orange peels were later cut into small pieces

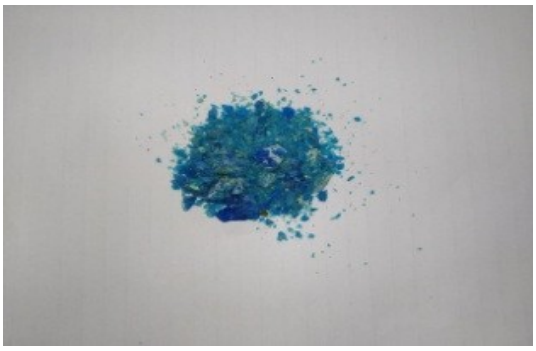
#Step 4 - Powdered Orange Peels

#Step 5 - Collected Powdered stockpiled in air tight container

7.1 Method of Copper (Cu) Adsorption

The 250 ml solution which are at a concentration of 5 ppm in a beaker were subjected to 0.5 and 1 Gram of adsorbent [powder of orange peels]. The range of pH was 4 -7. The adjustments were doing using a 0.1 M solution of HCl & NaOH. After that the beaker were subjected agitation of 100 RPM with contact time of 30 minutes, 60 minutes, 90 minutes & 120 minutes. Later the mixture was filtered using Whatman filter paper no.1 & given to the UV-Spectrophotometer to check the adsorption of heavy metals by adsorbent.

#Step 1 - Copper Sulfate



#Step 2 - Copper stock solution

#Step 3 - Stirring of Solution

#Step 4 - Final Treated Solution

III. ANALYSIS

8.1 Experimental data

Note: - Orange Peel Powder (OPP) use 0.5 Gram Per Dose.

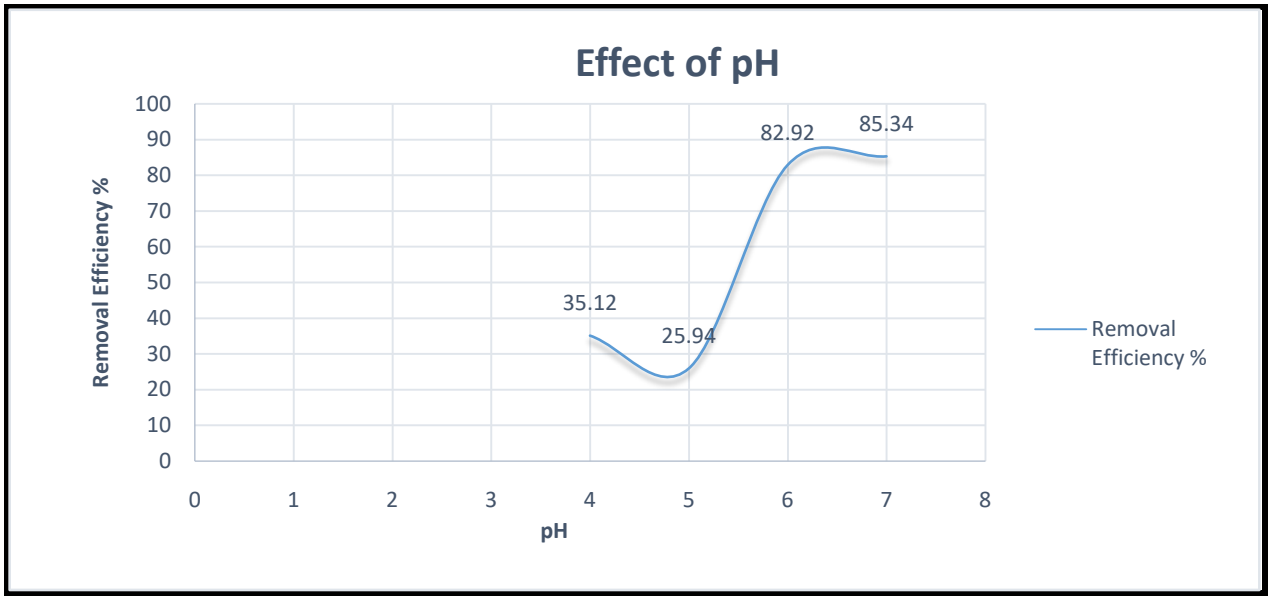
Initial conc.(ppm)	Final conc.(ppm)	pH	RPM	Contact time(min)	Removal efficiency
5	3.244	4	100	30	35.12%
5	3.703	5	100	60	25.94%
5	0.854	6	100	90	82.92%
5	0.733	7	100	120	85.34%

[Table 1: Experimental date of Copper (Cu) Removal Efficiency in Percentage]

8.2 Factor affecting adsorption

8.2.1 Effect of pH on adsorption of heavy metals

The pH is one of the imperative factors governing the adsorption of the metal ions which effects of the functional group's protonation and also, the metal chemistry. Graph 8.1 showed the removal of aqueous solution of Cu at varying pH range from 4 to 7 under the precise conditions (initial metals concentrations 5 ppm, at constant contact time of 30, 60, 90, 120 minutes, with 0.5 g of the adsorbents used, and at a room temperature of 25 $^{\circ}$C). It obvious from the results the removal of studied ions increased markedly with low pH values. The maximum adsorption of pH ranged between 6 and 7 with removal efficiency ratio reachedto above 80%, then the efficiency gradually by increasing pH values. At pH 4 and 5, maximum removal was obtained for 35.12%, and 25.94% removalefficiency, respectively. While 85.34 % removal efficiency of Cu ions was achieved evenat a pH of 7.



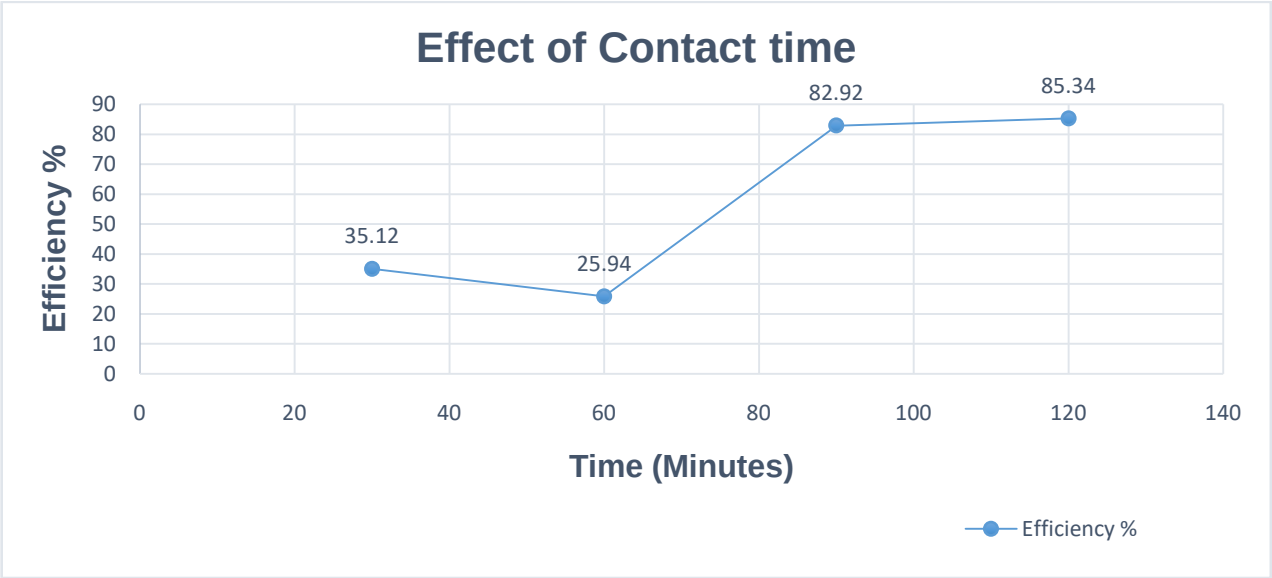
Graph 8.1 - Effect of pH on removal of Copper (Cu) by orange peel, initial concentration 5 ppm

8.2.2 Effect of contact time on adsorption of heavy metals

Graph 8.2, illustrates the effects of soaking time on removal capacity of heavy metal ions using 0.5 gram of the orange peel powder at room temperature 25 ^{0}C for fixed intervals of 30, 60, 90, 120 minutes. the obtained results reveal that the metal ions removal efficiency was increased as increases of contact time. this is due to prolonged contact between the sorbent surface and the metals ions.

The percentage Copper (Cu) ions removal approached equilibrium within 30 and 60 minutes for removal efficiency reached to 35.12% and 25.94%, while for Copper ions recorded 90 and 120 minutes with removal efficiency of 82.92 and 85.34 % respectively.

From Graph 8.2, it was clearly that, the rate of adsorption is higher within the 120 minutes due to large available surface area of the adsorbent and a high concentration gradient. By time is passed, exhaustion of adsorbent's active sites will be happened thus attained the equilibrium, further the rate of uptake is controlled by the rate at which the adsorbate is transported from the exterior to the interior sites of the adsorbent particles.



Graph 8.2 - Effect of contact time on removal efficiency using OPP

IV. RESULTS AND DISCUSSION

Experiments were carried out at different pH 4, 5, 6 and 7 and different contact time 30 min, 60 min, 90 min and 120 min respectively for removal of copper from industrial effluent by using the OPP. It is observed that at pH 4 and Contact time 30 min removal of copper is 35.12%. On the other hand, at pH 5 and Contact time 60 min removal efficiency decreased to 25.94%.

It is perceived that 82.92% copper was removed while doing experiment at 6 pH and given 90 min of Contact time.

Based on above experiments, maximum efficiency 85.34% for the removal of copper ions with the help of 0.5-gram Orange Peel Powder (OPP) can be obtained on maintaining optimum condition pH 7 and Contact time 120 minutes.

V. CONCLUSION

When the dried peels of oranges have used the result obtained by us were quite accepted. The results obtained were positive and it is been proved that this method is going to be most effective. The peels were able to remove Copper metal present in the solution. The dried peels where been proved more beneficial as compared to individual powder and peel. As this method is based on agricultural waste automatically it can be said that it cost effective as well. This technique is eco-friendly and cost-effective as well, it will surely enhance the growth of our environment. The industry sector can make a wide use of it as it will prove the best cost-cutting their waste water.

In this study, orange peel adsorbent was used successfully for the adsorption of Copper (Cu) metals ions from their aqueous solution. The obtained results revealed that the adsorption of metals ions is time dependent, pH dependent and adsorbent dosage dependent. Orange peel is inexpensive natural waste and readily available, thus this study provides a low-cost effective means for removing metal ions from contaminated effluents.

VI. REFERENCES

[1] https://en.wikipedia.org/wiki/Copper

[2] Annadurai, G., Juang, R. S., and Lee, D. J., Adsorption of heavy metals from water using banana and orange peels. Water Science and Technology, 47(1), 2003, 185- 190.

[3] Abid, M., Niazi, N. K., Bibi, I., Farooqi, A., Ok, Y. S., Kunhikrishnan, A., and Arshad, M., Arsenic (V) biosorption by charred orange peel in aqueous environments. International journal of phytoremediation, 18(5), 2016, 442-449.

[4] Moronkola BA, Giwa-Ajeniya AO, Alegbe MJ, Eshilokun AO, Awokoya KN and Okoh OO, The Adsorption of Divalent Metal Ions from Aqueous Media Using Unmodified Orange Peel as Adsorbent.

[5] Aakanksha Darge, S. J. Mane, "Treatment of Industrial Wastewater by using Orange Peels" International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013).

[6] KURNIAWAN T A, CHAN G Y S, LO W, BABEL S. Comparisons of low-cost adsorbents for treating wastewaters laden with heavy metals [J]. Science of the Total Environment, 2006, 366: 409−426.

[7] LIANG S, GUO X Y, FENG N C, TIAN Q H. Application of orange peel xanthate for the adsorption of Pb2+ from aqueous solutions [J]. Journal of Hazardous Materials, 2009, 170(1): 425−429.

[8] DHAKAL R P, GHIMIRE K N, INOUE K. Adsorptive separation of heavy metals from an aquatic environment using orange waste [J]. Hydrometallurgy, 2005, 79: 182−190T. Mohana Priya, Dr. M. Punithavalli & Dr. R. Rajesh Kanna, Machine Learning Algorithm for Development of Enhanced Support Vector Machine Technique to Predict Stress, Global Journal of Computer Science and Technology: C Software & Data Engineering, Volume 20, Issue 2, No. 2020, pp 12-20