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Deduction of Copper ions from Industrial waste water by Tea factory waste adsorbent

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ABSTRACT

Tea factoy waste was collected in Axom Tea (OPC) Private Limited Assam, the annually production of tea is 450 tonnes. The amount of tea factory waste (TFW) production/ ann. after processing is 88 tonnes. an study has been carried out to investigated the feasibility of the use of TFW as an adsorbent for the removal of copper heavy metal. Many industries feed toxic heavy metals in the river during manufacturing of battery, cell etc. Batch adsorption studies have been carried out for evaluating the suitability of tea factory waste as a low cost adsorbent for removal of heavy metal (copper) from wastewaters.

An Experimental setup is conduct by apply tea factory waste to wastewater as concentration (10 ppm), contact time (120 min), pH (4.5), adsorbent doses (1.2 gram) at room temperature. Maximum percentage removal of copper ions is 88 % at 4.5 pH, 120 contact times and 1.2 grams adsorbent.

Key words: Tea Factory waste, Copper, Adsorption, aqueous solutions, tonnes.

1. INTRODUCTION

Copper virus is the cumulation of heavy metals, in toxic amounts, in the soft tissues of the body. Signs & physical findings associated with heavy metal (copper) virus vary according to the metal cumulated . Lot of heavy metals, such as zinc, copper, chromium, iron and manganese, are crucial to body function in very little amounts. But, if these metals cumulation in the body in concentrations ample to cause poisoning, then serious deteriorated may occur. These heavy metals most frequently associated with poisoning of humans are lead, mercury and arsenic. Heavy metal poisoning may occur as a outcome of industrial subjective, air or water pollution, foods, medicines, improperly coated food containers, or the ingestion of lead-based paints.

These copper ions metals are also examine as trace elements because of their presence in trace concentrations (<10ppm) in various environmental matrices. Their bioavailability is determine by physical factors such as temperature, phase association, adsorption and sequestration. It is also affected by chemical factors that impactspeciation at thermodynamic equilibrium, complexation kinetics, lipid solubility & water partition coefficients. Biological factors such as species characteristics, trophic interactions, and biochemical/physiological adaptation, also play an important role.

The crucial heavy metals depot physiological and biochemical functions in plants and animals. They are major constituents of various key enzymes and play important roles in various oxidation-reduction reactions. The capacity of copper to cycle between an oxidized state, Cu (II) Ions, and reduced state, Cu(I) ions, is used by cuproenzymes involved in redox reactions. However, it is this property of copper that also makes it potentially toxic because the transitions b/w Cu(II) ions and Cu(I) ions can result in the generation of superoxide and hydroxyl radicals . Also, intemperate exposure to copper has been linked to cellular deteriorate leading to Wilson disease in humans. Nearly to copper, some other crucial elements are required for biologic functioning, however, an glut amount of such metals produces cellular and tissue harm leading to a variety of temedeous

effects and human diseases. Other metals like Sb, As, Ba, Be, Tl, Ti, V and uranium (U) have no established for non-crucial metals.

People have start to realize how Crucial excellent health is to them, and it is no longer merely principal to have a quality lifestyle for humanity. To maintain healthy life & stable environment it is important to keep good relation between health, population & environment. Day by day population growth is take place whicheffect our ecosystem. The population rises which directly increase amount of water and also affect water bodies. Expanding demand leads to the development of new resource & industries; by which more industries also increases. As a result of human health is also effects day by day by new industries grow. These new industries release heavy metal by this water became contaminated.

2. Material and Methods

2.1. Preparation of Tea Waste adsorbent

Tea waste was obtained from Axom Tea (Opc) Private Limited, India. TFW was dried first in sunlight; for before experiments, hydrolysable tannins and other soluble and colored components were eliminated from crushed tea waste by washing with boiled water four times and washing with dilute NaOH solution until the water was virtually colorless. Decolorized and cleaned TFW was dried in tray dryer at 1080C for 12h and screened to size 100µm particles were used in the adsorption experiments without any further modification. The physical and chemical properties of Tea factory waste is presented in Table 1

Table 2: Physical and chemical properties of TFW used in experiments

Characteristics	**Percentage**
Moisture (%)	5.61
Ash (%)	2.81
Volatile matter (%)	74.28
Fixed carbon (%)	17.3
Surface area (m^2/g)	2.1746
Bulk density (kg/m^3)	231.48

2.2. Equipment and reagents

In the experiment some glassware are utilized of borosil. The instrument and apparatus used in the experiment are listed in Table 3. The experiment solution is examineby UV-Visible Spectrophotometer (Shimadzu: Model UV-1700) at 312nm. The pH measurements were performed by employing a Systronics model 361 pH meter combined with a glass electrode. The adsorbate, Copper sulfate (molecular weight 159.609 g/mol, chemical formula = CuSo4.5H2o) was supplied by Satyam metal industries (India). All solutions were prepared in distilled water. Experimental solutions for copper ions (10 ppm, 20ppm , 30ppm, 40ppm and 50ppm) were prepared in 100 ml flasks.

Table 3: List of instrument and apparatus used in the experiment works

S. No.	**Instrument**	**Make**
1.	pH meter	Systronics (Model 361 pH)
2.	Magnetic Stirrer	Jyoti Scientific Industries
3.	Digital Weight Balance	K. Roy Instruments Pvt. Ltd.
4.	What man filter paper no.1	-
5.	UV-Visible Spectrophotometer	Shimadzu (Model UV-1700)

2.3 Procedure

The removal of copper ions by tea factory waste from aqueous solution (10ppm) was studied by a batch technique reactor at room temperature. Fresh industrial waste has been collected from nearby factory and stored at controlled environmental condition i.e.25 C Temperature in know volume. An 10 ppm concentration (industrial waste water) solution (4.5 pH) is feed in the RB flask at different dose (0.2 to 2.0 gram) at fixed 120 Min. RPM. Known quantity of treated tea factory waste (0.2 to 2.0 gram) was introduced into the aqueous solution (10PPM) at 120 min RPM. Filtrated this aqueous solution by Buckner filter and final concentration of metal ions in the solution were determined by UV. The effect of solution at different dose (0.2 to 2.0 gram) at fixed pH (4.5), 10 ppm concentration and 120 min. contact timethe % removal efficiency of copper ion is increase and decrease suddenly at 0.8 dose of adsorbent.

3. Results and discussion

In order to study the effect of different parameters on the adsorption of copper on TFW, the batch studies were carried out.

. 3.1 Effect of adsorbent dose

The effect of adsorbent dose on the percentage removal of copper ion at various initial copper concentrations (10 PPM) is shown in fig.1. To achieve the maximum adsorption capacity of the TFW for copper ion, the dose of TFW was varied from 0.2 to 2 grams at room temperature. Other parameters like the Agitation rate (120 rpm) and pH of 4.5 were kept constant. The result shows that the percentage of adsorption is increased with an increase in TFW doses from 0.2 to 2 g and then reaches the optimum removal at a particular amount of adsorbent. The optimum valve of adsorbent dose found to be 1.2 grams at 10ppm solution

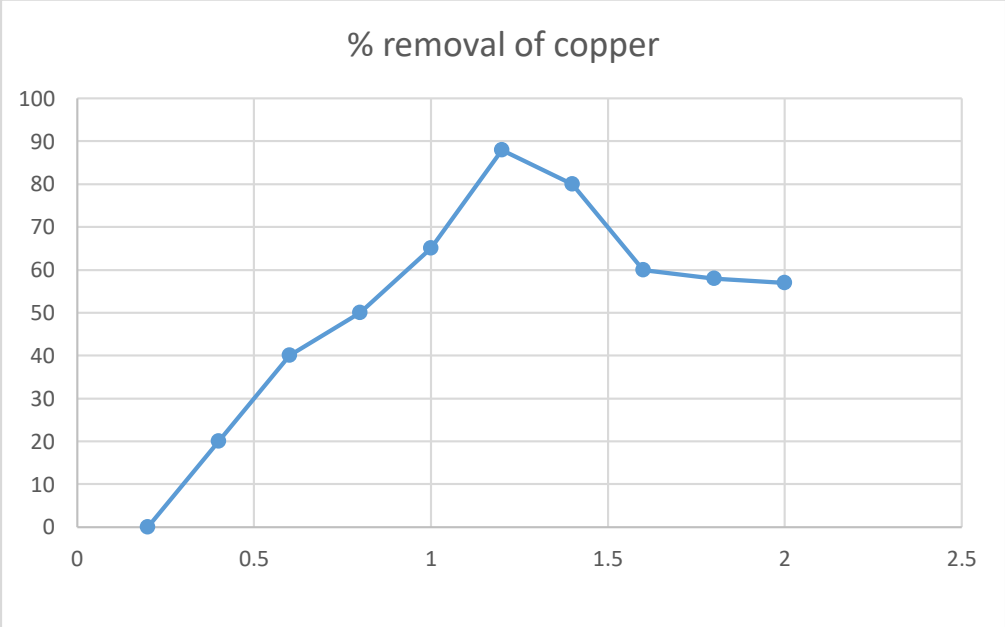

Fig. 1. Effect of Dose on % removal of copper ion by tea factory waste

3.2 Effect of Concentration

The effect of Concentartion on the percentage removal of copper ion at (1.2 gram) is shown in fig.2. To achieve the maximum adsorption capacity of the TFW for copper ion, the concentration of TFW was varied from 10 to 80 PPM at room temperature. Other parameters like the Agitation rate (120 rpm) and pH of 4.5 were kept constant. The result shows that the percentage of adsorption is increased with an increase in TFW doses

from 10 to 80 PPM and then reaches the optimum removal at a particular concentration. The maximum removal efficiency of copper ions is 10 PPM.

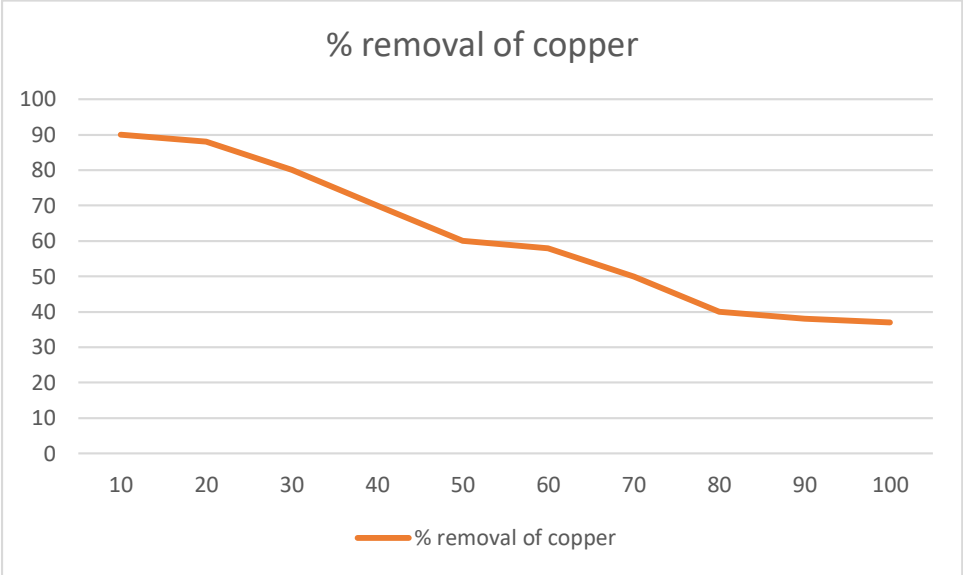

Fig. 2. Effect of conectration on % removal of copper ion by tea factory waste

3.2 Effect of pH

The effect of pH on the percentage removal of copper ion at (1.2 gram) is shown in fig.3. To achieve the maximum adsorption capacity of the TFW for copper ion, the pH of TFW was varied from 2 to 8 pH at room temperature. Other parameters like the Agitation rate (120 rpm), dose (1.2 gram) and pH 4.5 were kept constant. The result shows that the percentage of adsorption is increased with an increase in TFW doses from 10 to 80 PPM and then reaches the optimum removal at a particular concentration. The maximum removal efficiency of copper ions is 10 PPM.

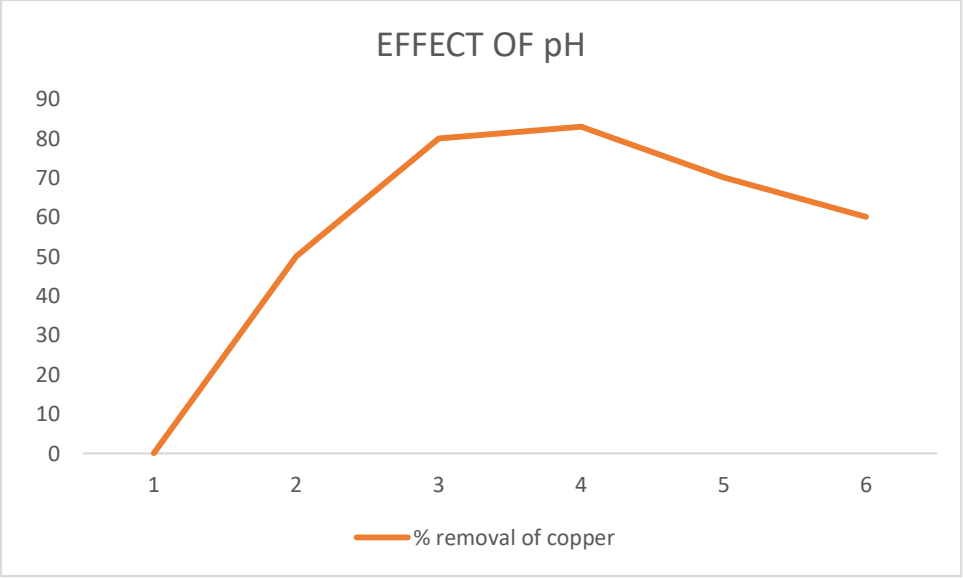

Fig. 3. Effect of pH on % removal of copper ion by tea factory waste

4. Conclusion

The optimum removal of copper ions at 4.5 pH, Contact time 120 min, adsorbent dose 1.2 gram at 10 PPM concentration is 88% efficiency.

References:

[1] U. Singh, R.K. Kaushal, Treatment of waste water with low cost adsorbent - A review, VSRD. Int. J. of Tech. & Non-Tech. Res. 4 (2013) 33-42.

[2] M. Hunsom, K. Pruksathorn, S. Damronglerd, H. Vergnes, P. Duverneuil, Electrochemical treatment of heavy metals (Cu^{2+}, Cr^{6+}, Ni^{2+}) from industrial effluent and modeling of copper reduction, Water Res. 39 (2005) 610–616.

[3] P. Maheswari, N. Venilamani, S. Madhavakrishnan, P.S. Syed Shabudden, R. Venckatesh, S.Pattabhi, Utilization of Sago Waste as an Adsorbent for the Removal of Cu(II) Ion from Aqueous Solution, E-J. Chem.5 (2008) 233-242.

[4] A. T. Paulino, F. A. Minasse, M. R. Guilherme, A. V. Reis, E. C. Muniz, J. Nozaki, Novel adsorbent based on silkworm chrysalides for removal of heavy metals from wastewater, J. of Coll. and Inter. Sci. 301 (2006) 479–487.

[5] Mitra, N., https://timesofindia.indiatimes.com/city/guwahati/assam-tea-producers-eye-tea-waste-export-to-boost-revenue/articleshow/70509293.cms.Accessed3Aug2019.

[6] https://www.acrplus.org/en/municipal-waste-management-covid-19. Accessed 24 March 2020.

[7] S.R. Shukla, S.P. Roshan, Adsorption of Cu (II), Ni (II) and Zn (II) on dye loaded groundnut shells and sawdust, Sep. Purif. Technol.43(2005) 1-8. https://doi.org/10.1016/j.seppur.2004.09.003.

[8] H.M. Aly, A.A.M. Daifullah, Potential Use of Bagasse Pith for the Treatment of Wastewater Containing Metals, Adsorp. Sci. Technol. 16 (1998) 33-38.

[9] F.J. Cerino-Cordova, P.E. Diaj-Flores, R.B. Garcia-Reyes, E. Soto-Regalado, R. Gomez-Gonzalez, M.T. Garza-Gonzalez, E. Bustamante-Alcantara, Biosorption of Cu (II) and Pb (II) from aqueous solutions by chemically modified spent coffee grains, Int. J. Environ. Sci. Technol. 10 (2013) 611-622.

[10] K.K. Panday, G. Prasad, V. N. Singh, Copper (II) removal from aqueous solutions by fly ash, Water Res. 19(1985) 869-873.

[11] T. Vengris, R. Binkiene, A. Sveikauskaite, Nickel, Copper and Zinc removal from wastewater by a modified clay sorbent, Appl. Clay Sci. 18 (2001) 183–190.

[12] K.L. Wasewar, M. Atif, B. Prasad, I.M. Mishra, Batch adsorption of zinc on tea factory waste, Desalination 244 (2009) 66-71.

[13] S. Cay, A. Uyanik, A. Ozasik, Single and binary component adsorption of copper (II) and cadmium (II) from aqueous solutions using tea-industry waste,Sep. Purif. Technol. 38 (2004) 273–280.

[14] S.S. Majumdar, S.K. Das, T. Saha, G.C. Panda, T. Bandyopadhyoy, A.K. Guha, Adsorption behavior of copper ions on Mucorrouxii biomass through microscopic and FTIR analysis, Colloid. Surface B. 63 (2008) 138-145.