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Use of *Ferronia Elephuntum* Fruit Shell Substrate for the Adsorption of Fe[II] Metal ION From Aqueous Solution

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ABSTRACT

Water reserve of the world are limited. The total amount of water on the earth is about 1.35 billion. Over 97% of this amount is found in the earth oceans and earth fresh water totals only about 37 million of which four-fifth occurs in polar ice caps and glaciers. It is clear that only a little amount of fresh water is accessible to human. This mearge quantity of water which is availabke for human use is also getting contaminated because of industrialisation, urbanisation and population exodus. Salts of various heavy metals and potentially hazardous material are being discharged in increasing amounts into the aquatic environment. Water containing significant concerntration of some of the heavy metal ions are toxic to human being, animal as well as aquatic organism . The toxicity of some heavy metal ions even at the trace level has been recognised with respect to public health for many years. Metal such as Hg, Pb, Cd, Cu, Fe[II], and Cr fall under this categories. Many metals have been evaluated as toxic to aquatic life above certain threshold toxicity level. Exposure to heavy metal toxicity can result from every facet of activity such as agriculture, mining, transport, energy and industry. Continue release of metal wastage into the environment has been justified in the basis of dilution to undetectable levels or to the level below the threshold toxicity level in the receiving water body.

Keywords : *Ferronia elephuntum fr*uit shell substrate, ferrous ammonium sulphate solution, uv spectrophotometer pH meter,shaking machine, batch experiment.

I. INTRODUCTION

Toxic heavy metals are released into the environment from the number of industries such as mining, plating,dyeing, automobile manufacturing and metal processing. The presence of heavy metals in the environment led to the number of environmental problem.[1]. In order to meet the water quality standard for most of countries, the heavy metal ions are stable and persistant environmental contaminant since they can't be degraded and destroyed[2]. These metal ions are harmful to aquatic life and water contaminated by toxic metal ions remains a serious health problem, so their concentration must be reduced to acceptable level before discharging into the environment, otherwise these can pose a threat to public health . The metal of the most immediate concern are Zn,Cr, Fe, Ni, Hg, Cd, Pb [3].

Due to awareness of the importance of the aquatic organism water quality manager concerned with environmental protection have developed method by which evaluation of biological effect of polluting substances can be carried out from the safety point of view . It is an urgent need to welldefine the safe amount of chemicals to control pollution and to protect the aquatic fauna. [4]

However the safety limit prescribed for many of the heavy metal ions we expected to be mofified from time to time in the light of further knowledge of their

toxic limit likely to be gained in future. The diacharge limit placed on the toxic metal ions and their effluent concentration one of the vital significance in guiding the treatment process to be adapted for a given waste treatment problem[5]. Several reviews are available on the various techniques applied for waste minimisation in removal of heavy metal from waste water.Several method that have been used for the treatment of toxic metal include adsorption, electrochemical, electrodialysis, electrolysis, filtration, flocculation, floatation, ion exchange, separation, neutralisation, oxidation, reverse osmosis and solvent extraction[6]. Substances in considerable excess amount will upset the balance of nature. Although traces of some heavy metals suppose to fill some essential role in nutrition, however exessive amount can induce toxic effect. Several heavy metal ions are known to exert their toxic effects particularly on the rapidly proliferating tissues such as the gastrointestinal mucosa, bone marrow on highly specialised cell such as neuron and renal tubular cell . [7]. The adsorption process play an important role in removing heavy metals such as Pb from waste water there has been much research into the development of lowcost alternatives to activated carbon, these material includes, flyash, metal oxides, zeolites, peats, chitosens, activated sludge . [8-9] . For low concentration of metal ions in wate water the adsorption process is highly recommended for their environment.Adsorption is one of the moat effective physical process for removal of toxic metal from waste water. It is a surface phenomenon which may be defined in terms of an unit operation that utilizes surface forces based in the concept of parting a chemical species between a bulk phase and a interphase. The surface of solid have residual forces thus the surface of solid has a tendency to attract an to retain molecule of other species with which such surface come in contact. Adsorption is a unique process has offered many advantages over the other process.

Adsorption can be used for creating toxic and hazardous organic and inorganic wastage recovery of valuable byproducts from the waste water is possible.

II. EXPERIMENTAL TECHNIQUES

Preparation of metal ions from aqueous solution

All the chemicals, ferrous ammonium sulphate, O-phenonthreline, hydroxylamine hydrochloride and pottasium periodate use of analytical grade. The metal ion solution of required concentration of Fe[II] were prepared from ferrous ammonium sulphate in double distilled water . The glaasware used were leached with conc. HNO3 and dried in an oven at 50^0C . The pH of ferrous ammonium sulphate solution was adjusted to 4-5 using buffer solutikn to prevent hydrolysis.

Preparation of fruit shell substrate -

Preparation of fruit shell substrate the bark of fruit were dried and finally powdered in an electric grinder machine and sieved passed through 60 mesh. 2 gm of powder was treated with 5 part of aqueous formaldehyde solution and 20 part of 0.2 N sulphuric acid . The whole mixture was stirred for 6 hours using commercial shaking machine . The mixture was then filtered and washed, several times with deionised water untill the pH of the filtrate was attained to 5. The residue was dried in an oven for 24hrs. The modified *Ferronia elephuntum* fruit shell was used for adsorption experimentof waste water treatment .

III. RESULT AND DISCUSSION

Batch studies were carried out by agiting a known weight of *Ferronia elephuntum fruit s*hell substrate placed in contact with 100 ml of metal ion solution of different concentration . The suspension was continuously sgirred in a shaker, the effect of pH and initial metal ion concerntration, contact time, adsorption doses and temperature have been studied. With pH range from 2-9 and for initial metal ion concentration from 30-90 mg/L of iron. The pH of

solution was adjusted by addition of acidic buffer, the contact time was varied from 5 min to 240 min. The conc. Of Fe[II] was determined spectrophotometrically.

1] EFFECT OF pH- The effect of pH on adsorption of Fe[II] is by increasing pH of the solution from 2-9 studies indicate that the system is strongly pH dependent. The rate of adsorption is maximum at pH4-5 . The %removal was found to increase upto certain extent and then decrease . This decrease in adsorption may be due to precipitation of metal hydroxide . The data shows that the adsorption of Fe[II] is optimum at 4-5 pH . It was reported that free metal ions are adsorbed better than hydroxides of metal ions hence pH 4-5vwas selected for all studies .

2] Effect of contact time.

Contact time is an important factor affecting removal, most of adsorption occurs within the half hours and increase very slowly. Further increase in. Contact time to decrease adsorption . Variation of time from 5 min to 240 min shows that maximum removal occurs in 30 min.

3] Effect of metal ion concentration- The concentration of Fe[II] from 70-100mg/L were used in experiment . The amount of metal ion adsorbed increase with concentration, however % removal increase with decrease in conc. Of Fe[II] .

4] Effect of Temp.- Temperature dwpwndwnce if adsorption studies of Fe[II] byaubstrate were studied over the range of 30-70 degree, increase in temp. Decreases the adsorption indicating that the process ia exothermic.

5] Effect of dosage of substrate- The effect of adsorbed dosage of Fe[II] study carried out by taking adsorbed dosages varied from 0.5gm to 4gm it is observed that the adsorption of fe[II] increases with increase in dosage of adsorbent.

IV. CONCLUSION

The adsorption behaviour are like typical ion excahnger with selectively characteristic . Hence, it has different affinity for differentmetal ions . The metal ions in the solution exchange with the H+ resulting into decrease in pH of the metal ions solution is less than the initial pH and the useful range of operation is limited by the H+ concentration to weekly acidic to basic condition. In that the metal ions bound by the basic substrate can be completely leached into the solution by regenerating it with N/10 mineral acid . The effect of contact time, initial metal ion concentration, dosage of substrate, temp, on the adsorption efficiency of substrate follow the typical trend as shown by any adsorbent.

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1. Effect of pH

Srno.	Initial pH	Initial conc in ppm	Conc. Adsorbed in ppm	% removal
1	3	35.04	29.87	85.24
2	4	35.04	33.73	96.26
3	5	35.04	34.54	98.59
4	6	35.04	34.27	98.80
5	7	35.04	31.92	97.80
6	8	35.04	31.95	91.09
7	9	35.04	29.8	91.18
8	10	35.04	28.55	85.05

2. **Effect of contact time**

1	Time in min	Initial conc in ppm	Conc ads. In ppm	% removal
2	5	35.04	32.5	92.73
3	15	35.04	33.57	95.56
4	30	35.04	34.05	97.14
5	60	35.04	34.54	98.57
6	90	35.04	34.54	98.57
7	120	35.04	34.54	98.57

3. Effect of initial metal ion conc

Sr.no	Initial conc in ppm	Con. Adsorbed in ppm	% removal
1	35.04	34.54	98.57
2	38.57	35.44	91.88
3	39.04	26.38	67.31
4	40.76	20.38	50.00
5	57.54	24.88	43.23
6	59.57	25.22	37.97

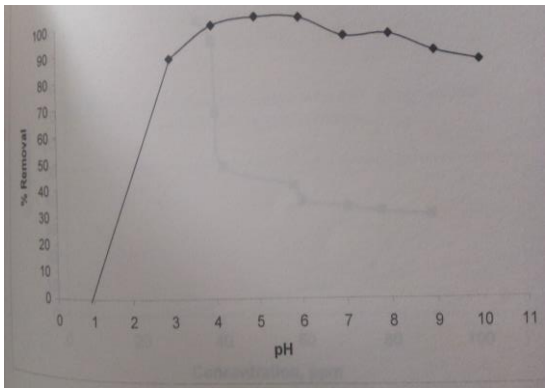
4. Effect of dosages of adsorbent

Sr.no	Substrate dosages in gm	Initial conc in ppm	Conc adsorbed in ppm	% removal
1	1	35.04	33.72	96.23
2	2	35.04	33.94	96.86
3	3	35.04	34.1	97.32
4	4	35.04	34.13	97.30
5	5	35.04	34.21	97.83
6	6	35.04	34.23	97.69

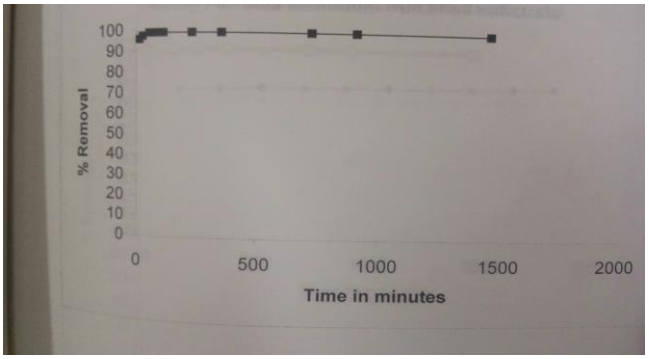
5. Effect of temp

Sr.no	Temp in 0 C	Initial conc in ppm	Conc adsorbed in ppm	% removal
1	30	35.04	34.54	98.57
2	50	35.04	18.84	53.77
3	70	35.04	14.64	41.79
4	90	35.04	10.74	30.66

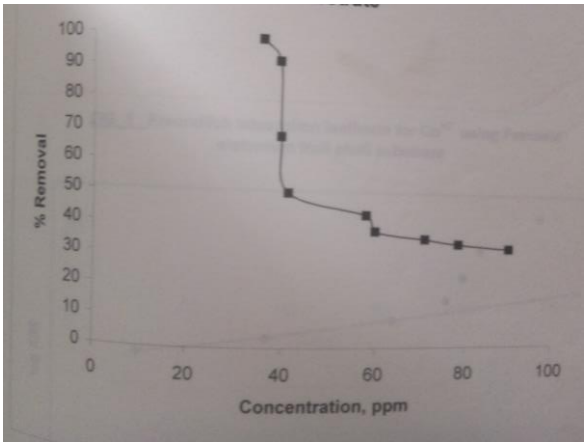
1. Effect of pH.



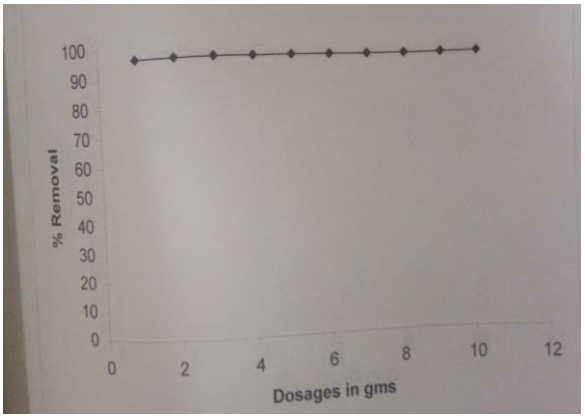
2. Effect of contact time



3. Effect of initial metal ion conc.



4 Effect of Dosage



5 Effect of Temperature