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Use of Column for the adsorption of Ni(II) and Cu(II) from aqueous solution using Acasia arabica tree bark substrate

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ABSTRACT

Salt of various heavy metals and other potentially dangerous are being discharged into the aquatic environment. Water containing vital concentration of some of heavy metal ions are harmful to human being, animal as well as aquatic organisms. The toxicity of some heavy metal ions, even at the trace level has been recognised with respect to the public health for many years. Metals such as Mercury, Lead, Cadmium, Copper and Chromium are under this category. Many metals have been evaluated as harmful to aquatic life above certain toxicity level. Any type of pollution brings about noticeable changes in the physiochemical parameters of the water, therby making it unsuitable for some beneficial uses. Thus, pollution causes changes in almost in the parameter. When increasing the pace of industrialisation along with population explosion, urbanisation and green revolution are reflected in varying degree of purity of water, soil and air. Majority of industries are water based and considerable volume of waste water is discharged to the environment either untreated or inadequately treated leading to the problem of surface and ground water pollution. The capital cost and operating waste water treatment system are rising on one hand and on the other there is a pressing demand for the treatment of waste water generated by increase residential and industrial development.

Keywords : Tree bark of Acasia arabica 20mm diameter column, UV spectrophotometer, shaking machine, Cu(II) and Ni(II) metal ion solution.

I. INTRODUCTION

Many industries may have specific waste problems, where the particular metal is an integral part of the manufactjring process. Notable examples are the high zinc waste of viscous rayon manufacturing, ground wood pulp production and news- paper print production. Similarly, Cd and Ag may found in photographic, porcelain, ceramic and pigment printing wastages. Other examples of metals that can pollute water include Pb from battery manufacturing and gasoline and antiknock agent. There are 5 different sources from which metal pollution of environment originates,

1) Geological whethering.
2) Use of metals and metal components.
3) Industrial processing of ores and metals
4) Leaching of metals from Garbage and solid waste dumps.
5) Animal and human excretion which contain heavy metals.

ENVIRONMENTAL POLLUTION

Pollution of environment is one of the most horrible ecological crises to which human being are subjected today. It is well known that three basic amenities are needed for living organisms i.e ear, land or soil and water. Sometimes in the past , these amenities were

pure, virgin, undisturbed, uncontaminated basically most hospitable for living organism. But , the situation is just reversed today, because of progress in science and technology is also leading to pollution of environment and serious ecological imbalance, which in the long run , may prove disastrous for mankind. Environmental pollution is the result of Urban-industrial , Technological revolution and speedy exploitation causing fast depletion of every bit of natural research.

TOXIC EFFECT OF Cu(II)

Cu(II) is one of the oldest method known to man is probably the first metal to be implied by him for useful purpose. Copper is found with sulphide deposits along with Pb, Cd, Zn and ia also considered as an important Chalcophite element. It is present in zinc concentrate , smelters and water in small quantities. Copper is found incapable of carrying oxygen. It is an essential nutrient for not only animal but also for plants and lower forms of organisms. Copper has many uses in industrial and house hold appliances. Abundant absorption of Copoer in man results in "Wilson's disease" in which excess Cu(II) is deposited in brain, liver,skin, pancreas and myocardium. Cu(II) salts are used for controlling biological growth in reserviors, water distribution pipes and catalysing the oxidation of Mn. Symptom of Cu deficiency are loss of weight, microcytic hypochromic anemia , disturbance in ossification and impartment of collagen formation. Toxic symptoms are hemolytic crisis, jaundice, neurological disturbances.

TOXIC EFFECTS OFNi(II)

It is an essential trace element. Ni stabilises the coiled ribosome and its occurence in bacterial hydrogenase and urease enzyme shows that the Ni is very essential to activity. It is highly carcinogenic and high level of Ni include the reduction of N2 retention and cause impaired growth. The deficiency of Ni in animal results in the impaired growth and an increase foetal death rate. Generally Ni and most Ni salts are not considered to cause a systemic poisoning. This from of dematitis occurs cheaply in person involved in Ni plating operation, which is marked variation in degree of suseptibility. They have been several occasional report of Ni poisoning resulting from inhabilation of Ni dust during polishing poeratins or in the production of alkali-Cd-Ni storage batteries. Ni has been found in the hair of person exposed to Nickel oxide dust, but no systemic effect that could be attributed to Ni have been reported . The high incidence of Carcinoma of their repiratory passage among workers of long service in Ni refineries has come to be recognised. Peculiar soot like odour , preceptible when one part of Nickel carbony is present in 2 million part of air .

II. MATERIAL AND METHOD

Preparation of tree bark substrate first the bark were dried and finally powdered in an electric grinder machine. 2gm of powder was transferred with 5 ml of aqeous formaldehyde solution and 20ml of 0.25N sulphuric acid. The whole mixture was stirred occasionally for six hours at ambient temperature and filter. The residue was washed with distilled water and pH of the filtrate was 4-5 till it was free of sulphuric acid and then dried in an electric oven at 600 C , till it was moisture free and then powdered. Treatment with formaldehyde in acidic medium polymerise and insolubilises the coloured water soluble organic constituents of the tree bark substrate.The bark substrate sample thus prepared were used for further studies.

Preparation and Estimation of Cu+2 ions solutions

Approximately 0.001M solution of coppersulphate BDS grade was first lrepared by dissolving requisite amount of salt in small volume of distilled water in volumetric flask and volume made up with distilled water. The stock solution of copper sulphate prepared above was taken in 500ml volumetric flask and to this add 10ml of citic acid ammonia buffer of pH 8.5 and then 10ml of 0.2% sodium diethyl dithiocarbamate in

distilled water and 10ml of carbon tetrachloride was added and the mixture was shaken vigorously for 2 min. Measure the absorbance of aqueous layer using visible spectrophotometer, measuring the absorbance a plot of absorbance vs the concentration was then made. The plot was farely linear showing adherance to the concentration of unknown Cu(II) solution were found out.

Preparation and Estimation of Ni+2 ions solution

One litre of 0.0001M solution was prepared by dissolving requisite amount kf Ni sulphate BDH, AR grade in distilled water. 10ml of this solution was then transferred to beaker and distilled to 50 ml by distilled water. 5 gm of citric acid and dilluted ammonia solution were added untill the pH was 7.5 . The solution was then transferred to a separating funnelb, 20 ml of DMG solution in dilute ammonia was then added and the solution was then kept steady for 2 min. 10 ml of chloroform was then added to the above solution and was vigorously shaken. Measure the absorbance of aqeuous layer using visible spectrophotometer. This plot was farely linear showing the concentration of unknown Ni (II) solution were find out.

III. RESULT AND DISCUSSION

A column of the tree bark substrate was prepared in a glass tube of 20mm internal diameter. The metal solution of 2-3 litre was passes through from top through the column and collected at the bottom (throw pot volume). The metal contains in the solution was analysed by given method . The rate of flow of solution was maintained at 3-4ml/min.

The result obtained from the studies are given in table and figure. The result shows that after 70 -90 ml throw pot volume collection , the percentage removal decreases. This may be because of the blockage of adsorption site of substrate by metal ions. Thus, it can be seen that Cu and Ni present in the solution are removed by the substrate column to the large extent. The results clearly indicate that by utilising adequate column of Acasia arabica tree bark substrate , it is possible to reduce toxic heavy metal ions concentartion in solution.

Adsorption of Cu(II) from coppersulphate. Solution using packed coulmn of Acasia arabica. Tree bark substrate Table 1.

Sr.No.	Time in min	Throwpot Vol.	Initial Conc. in ppm (Co)	Residual Conc. in ppm	Conc. Adsorbed in ppm (C)	Percentage Removal
1	15	50	23.11	19.97	3.14	13.58
2	30	60	23.11	14.84	8.27	35.78
3	60	70	23.11	4.59	18.52	80.13
4	90	80	23.11	7.70	15.41	66.67
5	120	90	23.11	7.70	15.41	66.67
6	240	100	23.11	7.73	15.38	66.19
7	360	110	23.11	6.90	16.21	70.13
8	720	120	23.11	7.38	15.73	68.05
9	1440	130	23.11	7.52	15.59	67.45

Adsorption of Ni(II) from nickel sulphate solution using packed col. Acasia arabica tree bark substrate. Table 2

Sr.No.	Time in min	Throwpot Vol.	Initial Conc. in ppm (Co)	Residual Conc. in ppm	Conc. Adsorbed in ppm (C)	Percentage Removal
1	15	50	39.31	19.88	19.43	49.43
2	30	60	39.31	17.32	21.99	55.93
3	60	70	39.31	8.62	30.67	78.07
4	90	80	39.31	3.68	35.63	90.63
5	120	90	39.31	6.50	32.81	83.46
6	240	100	39.31	7.59	31.72	80.69
7	360	110	39.31	7.98	31.33	79.69
8	720	120	39.31	8.13	31.18	79.31
9	1440	130	39.31	8.19	31.12	79.16

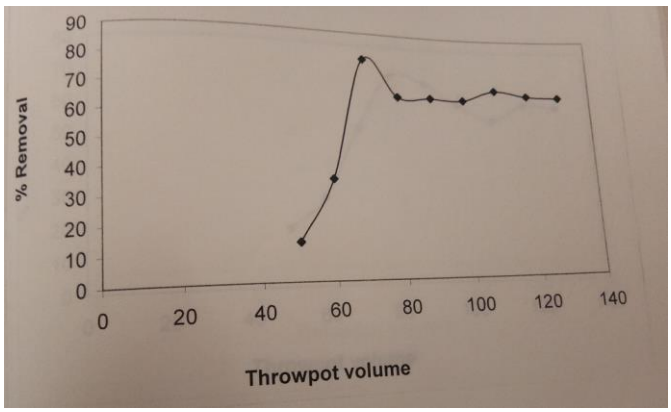

Fig 1 Adsorption of Cu(II)

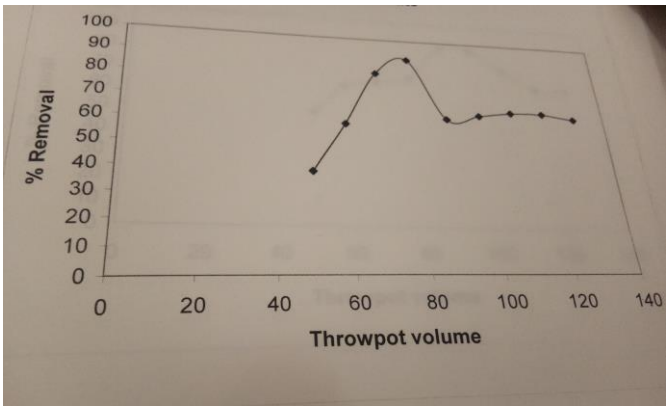

Fig 2 Adsorption of Ni(II)

IV. CONCLUSION

Modern civilisation with its rapidly growing industrial unit, increase in economic activities and population explosion has lead to an accelerated pollution of fresh water bodies. With exploiding population an increasing industrialisation and urbanization water pollution by agriculture, municipal and indhstrial sources has become a major concern for the welfare of mankind. Owing to increase in industrialisation on one hand and exploiding population on other , the demand of water supply have been increasing tremendously . Moreover, considerable part of this limited quantity of water supply is polluted by sewage , industrial wastage and wide array of synthetic chemicals . Thus, the quality as well as quantity of clean water supply is of vital significance for the welfare of mankind. The process of adsorption is a powerful tool for the environmental engineers and chemicals and has many applications for treatment of municipal and industrial waste water. The substrate now prepared are inexpensive and may be useful in removing toxic metal ions from industrial waste water to within the acceptable effluent discharge limit prescribed by environmental protection authorities. The cost of preparation of this substrate is quite low and is within the reach of even small industrial unit which can not afford the convential treatment technique. The substrate used for adsorption can be regenrated and reused again for the column studies.

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