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Removal of Iron from Aqueous Solution using Neem Leaf Powder as an Adsorbent

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ABSTRACT: A natural adsorbent made from Neem tree leaves (*Azadirachta Indica)* and used as a fine powder was found to be very effective to remove metal ions from water. In this work, removal of iron from water was studied by using neem leaf powder as an adsorbent with varying contact time and its concentration. The maximum removal of iron was noted 94.8364% when the sample was kept under contact of adsorbent of dose 200mg/l for 180 minutes.

KEYWORDS: Removal, Iron, Neem leaf powder

I. INTRODUCTION

Iron is the second most abundant metal present on earth. The most common source of iron in groundwater is by decomposition of iron containing rocks. Industrial waste, rusting or corrosion of water supply pipes and reservoirs also causes contamination of water by iron. The permissible limit set by BIS (Bureau of Indian Standards) for iron in drinking water is 0.3mg/l, when exceeds this limit in public supplies it cause turbidity, inadequate taste and odor, staining of laundry and plumbing. In humans, if the iron is present in excess it causes stomach upset, ulcers, mental retardation, liver and brain damage. Therefore, it is necessary to remove iron from water and bring it down under its permissible limits.

Various methods are adopted to remove heavy metals from water including chemical, biological, physical treatments. However these methods are quite expensive and difficult. Hence there is need of easy and cost effective method to remove heavy metals including iron from water. Agricultural bi-products such as hazelnut hull (Ali Sheibani et al. 2012), duckweed (Jameel .M. Dhabab 2011), pomegranate peel carbon (Masoud Rohani et al. 2013), moringa oleifera i.e. *drum sticks* (Desai B. et al. 2013), rice husk ash (Sathy Chandrasekhar 2006), banana and orange peels (G. Annadurai et al. 2002) and coconut shell charcoal (K.S. Beenakumari 2009) were tested to remove heavy metals from aqueous solutions. The adsorption behavior of Chromium (Arunima Sharma 2004), Copper (Novie Febriana 2010), Zinc (Reena Malik 2012), and Nickel (L. Lisy 2016) from water on neem had been studied earlier.Arunima Sharma and Krishna G. Bhattacharyya used fine powder made from neem leaves to remove Chromium from aqueous solutions, a small amount of adsorbent i.e. 1.6 g/l of neem leaf powder removed 87% of Chromium in 300 minutes from the sample of concentration 14.1 mg/l. Novie Febriana, Sisca O. Lesmana, Felycia E. Soetaredjo, Jaka Sunarso and Suryadi Ismadji used neem leaf powder to remove copper ions from aqueous solutions and found the maximum adsorption capacity of neem leaf powder as 18.29 mg/g. Reena Malik, Suman lata and Sushila Singhal developed an adsorbent from neem leaf to remove Copper and Zinc from water. The study showed that the powdered form of neem leaves used as an adsorbent is very effective in removing Copper and Zinc from water. The maximum Copper removal was 76.8% and Zinc removal was 88.6%. L Lisy and L Subha compared the adsorption behavior of Nickel on neem bark charcoal and commercially activated carbon. The study showed that adsorption of Nickel on neem bark charcoal was 80% under optimum conditions.

II. MATERIALS AND METHODOLOGY

The stock iron solution was prepared by slowly adding 20 ml of concentrated H_2SO_4 to 50ml water and dissolving 1.404 g $Fe(NH_4)_2(SO_4)_2.6H_2O$. A 0.02M Potassium permanganate was slowly added until a faint pink colour persists. Last few millileters of the solution was added dropwise. Then the solution was diluted to 1000 ml with water and

mixed properly. 1.00 ml of this stock iron solution was equal to 200 µg Fe. This stock iron solution was further diluted to make standard iron solutions. A ready to use fine powder of neem leaves was directly purchased. After preparing the standards the water samples of known iron concentration were treated with neem leaf powder and then filtered using the Whatman filter paper 42. The filtered samples were then analyzed for iron concentration by using an Atomic Absorption Spectrophotometer (Shimazdu AA- 7000).

III. RESULTS AND DISCUSSION

The effect of neem leaf powder when added to the water containing iron up to some extent was studied by varying the concentration of adsorbent and its contact time from 60 minutes to 180 minutes. At 60 and 120 minutes of contact time the removal was very low. Only at contact time of 180 minutes the removal of iron was considerable and was taken within the permissible limits. The figures shows the effect of contact time and concentration of adsorbent.

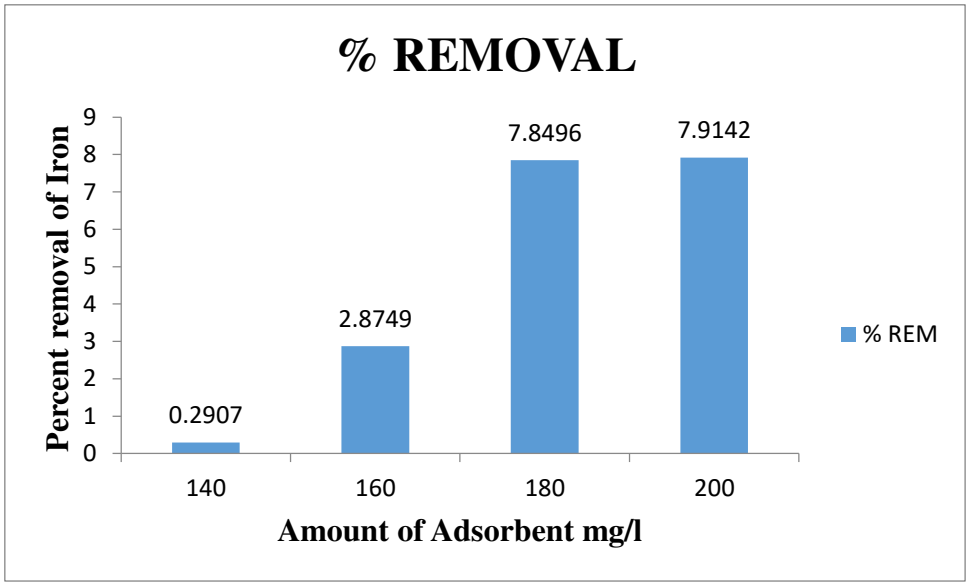

Figure 1. Effect of adsorbent dose on the removal of iron with contact time 60 minutes

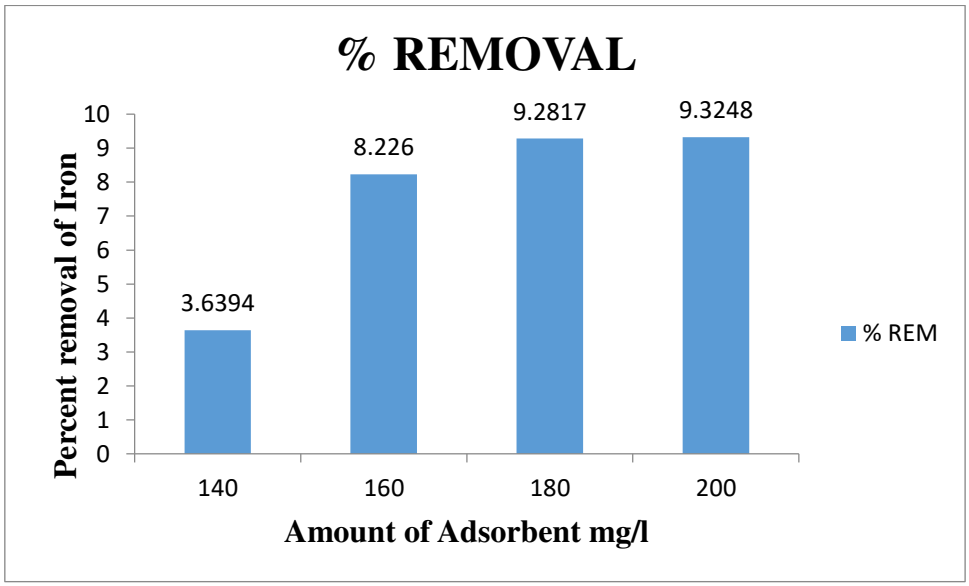

Figure 2. Effect of adsorbent dose on the removal of iron with contact time 120 minutes

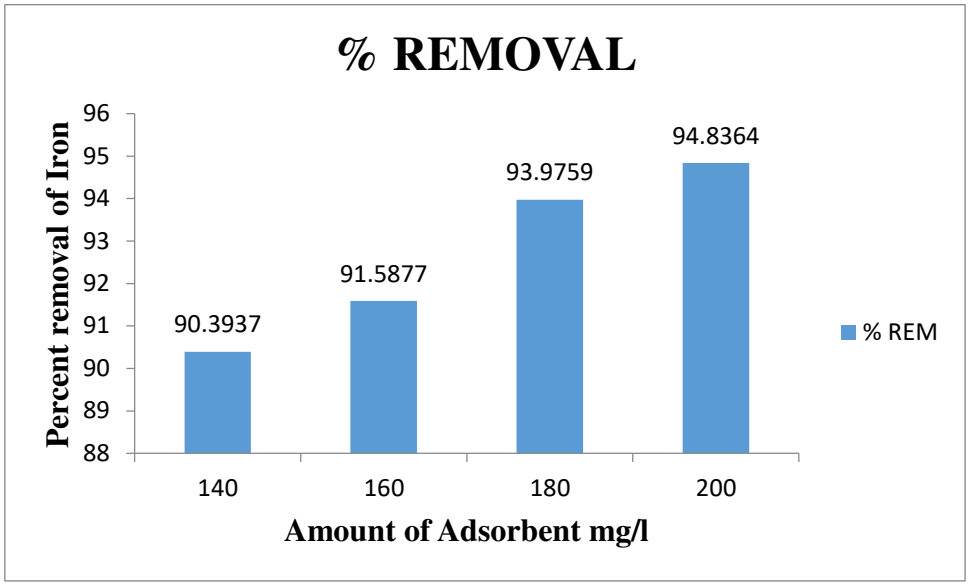

Figure 3. Effect of adsorbent dose on the removal of iron with contact time 180 minutes

As shown in above figures, for the contact time of 60, 120 minutes the adsorbent did not make much difference. But, for 180 minutes it removed iron from the aqueous solution to maximum quantity. The iron concentration was brought down from 0.9296mg/l to 0.0480mg/l. The sample volume taken for the experimentation was kept constant to 50ml.

IV. CONCLUSION

This study shows that under optimum conditions neem leaf powder was suitable in removing iron from aqueous solutions due to its high adsorption capacity, low cost, availability. The removal of iron was dependent upon amount of adsorbent and also contact time. The maximum iron removed was 94.8364% at contact time of 180 minutes and 200mg/l amount of adsorbent.

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