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Acetic Acid Adsorption on Rice Husk Adsorbent

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ABSTRACT

Low cost treatment of the wastewater is the need of the hour. Wastewater treatment can be carried out by various chemical, physical and biological methods. Water treatment technologies in the developing world typically focus on removing various types of impurities from waste water such as suspended solids, microbial pathogens, inorganic and organic components. Adsorption by using low cost adsorption is widely studies treatment method. Activated carbon has the capacity to remove these problematic chemicals from waste water. A simple, inexpensive and effective activated carbon production process use local agriculture waste. Acetic acid is present in the effluent from petroleum, fine chemical, pharmaceutical and textile industry. The present research is carried out to remove acetic acid from synthetic effluent using adsorbent prepared from rice husk.

Key words: Adsorption, activation, percentage removal, activated carbon.

INTRODUCTION

The amount of wastewater generated from industries activities has become a serious pollution problem. The water pollution is caused by organic and inorganic chemicals and waste. One of the important pollutants is acetic acid. Waste streams from many chemical and petrochemical industries contain dilute acetic acid. The industries contain acetic acid in wastewater are petrochemical, process and fine chemical industries. Many conventional treatment methods have been utilized for wastewater treatment for removal of organic and inorganic components [1-6] Many of these methods are expensive. Adsorption process is found to be the most efficient, economical and environmentally friendly method for separation of organic and inorganic components from wastewater. [7-10] Adsorbents are classified into natural adsorbents and synthetic adsorbent. Natural adsorbent include charcoal, clays, minerals, zeolites, and ores.

Adsorption of dichlorophenoxy-acetic acid onto date seeds activated carbon was investigated by Salman and Saud. [11] They worked on three adsorption isotherms model in which Langmuir isotherm model showed good adsorption capacity as compared to other two isotherm models. Hussain et.al. carried out research on adsorption studies of acetic acid. [12] Acetic acid adsorption using batch adsorption process was investigated. They studied the effects of various parameters on adsorption and tested Freundlich and Langmuir isotherm. Also they reported the various thermodynamic properties such as Gibb's free energy, enthalpy and entropy.

Okeola et.al. studied activated carbon prepared from Jatrophacurcas fruit pericarp and seed coat. Activated carbon was prepared from fruit pericarp and seed coat. [13] The results showed that activated carbon made from both parts of fruits acts as effective adsorbent. Abbasi and Alikarami investigated kinetics and thermodynamics of acetic acid adsorption from aqueous solution by peels of banana. [14] The objective of their study was to evaluate the

efficiency of banana peels as adsorbent for acid acetic from aqueous solution. The effects of initial acetic acid concentration, agitation time and temperature on adsorption of acetic acid onto peels of banana were investigated. The Freundlich model agreed very well with experimental data. In the present investigation, rice husk is used as raw material for adsorbent preparation. The adsorbent was prepared by chemical and thermal activation. It was then screened and used for adsorption experiments.

MATERIALS AND METHODS

As shown in fig.1, five clean 250 ml conical flask were added with 50ml, 40ml, 30ml, 20ml, 10ml dilute acetic acid and 0,10,20,30,40 ml water. 10 ml of each solution was titrated with 1N NaOH using phenolphthalein as an indicator for determination of acetic acid concentration. Then 1gm, 2gm,3gm,4gm,5gm of adsorbent was added in each flask. The filter papers were placed on the funnel and solution was poured over it. The samples were analyzed for acetic acid by titration method.

Fig.1: Experimental set up

Effect of Contact Time

The adsorption experiments were conducted and the extent of removal of acetic acid was obtained by varying the contact time from 10 to 60 minutes at fixed initial concentration of acetic acid and fixed dose of adsorbent (2 g) at 28ºC. The rate of removal of acetic acid was observed to be higher at initial stage, due to adequate surface area available of adsorbent and adsorption decreases with increase in contact time indicating reduction in available surface area.

Effect of Adsorbent dosages

The adsorption experiments were conducted and extent of removal of acetic acid was obtained by varying the adsorbent dose from 1 to 5 gm at fixed initial concentration and fixed contact time.

Effect of Initial concentration

The adsorption experiments were conducted and extent of removal of acetic acid was obtained by varying initial concentration.

RESULTS AND DISCUSSION

Experiments were carried out to study effects of parameters like initial concentration, contact time, and adsorbent dose on acetic acid removal percent. Effect of initial concentration is shown in fig.2. It was observed from experiments that, as the initial concentration increases the percentage reduction increases. Fig.3 shows effect of contact time on acetic acid removal. It can be seen that, as time increases, the percentage reduction of acetic acid also increases. Because adsorption is function of time. At time 35 min percentage reduction was 8.375. As time increases upto 60 min percentage reduction was 23.604.The rate of removal of acetic acid was observed higher at initial stage, due to adequate surface area available of adsorbate.

Fig.4 shows effect of adsorbent dose on removal. As the dose of adsorbent increased, percentage reduction also increased. As 1 gm of adsorbent adsorbed 16.21% while 5 gm of adsorbent adsorbed 28.37% of acetic acid. The reason was availability of active sites due to the increase in the effective surface area resulting from increase in dosage of adsorbent and conglomeration of the adsorbent, especially at higher adsorbent dosages. The maximum percentage reduction was observed at pH 8 and it was 28.2%.

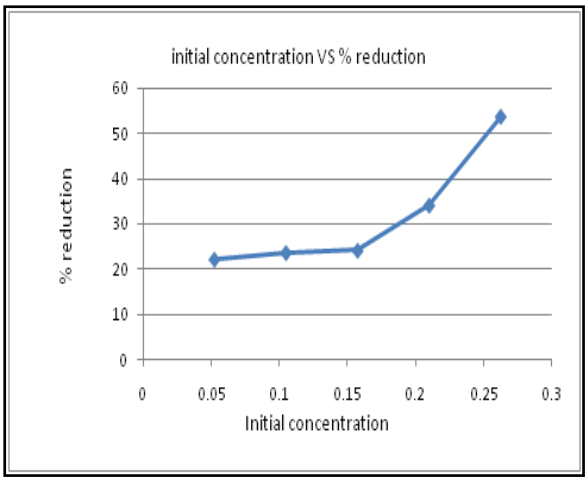

Fig.2: Effect of initial concentration

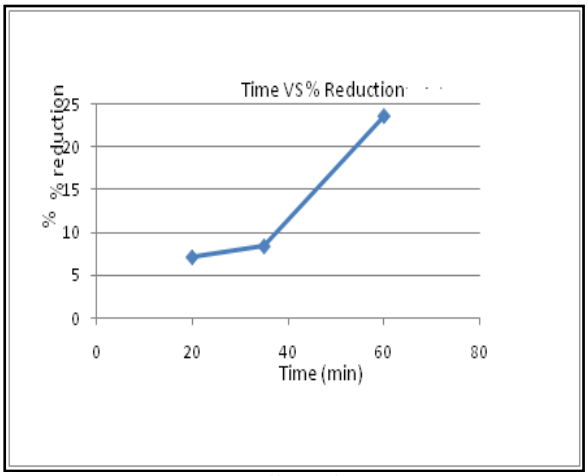

Fig.3: Effects of time

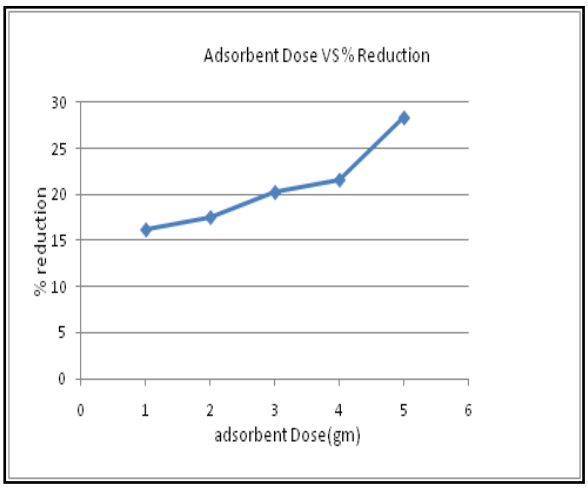

Fig.4: Effect of adsorbent dose

CONCLUSION

The investigation demonstrated that, the use of natural ingredient as raw material for preparation of activated carbon is possible. Adsorption on rice husk adsorbent can be efficient and economical for the removal of acetic acid from waste water. The percentage of reduction increases with increases in adsorbent dose. It increased with increase in contact time.

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