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Adsorption Studies of Acetic Acid Removal from Waste Water Using Seeds of Brassica Nigra

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ABSTRACT
The present work investigates the potential use of biosorbent prepared from the seeds of *Brassica nigra* commonly called as 'Black Mustard' for the removal of acetic acid from wastewater. Environmental problems are growing day by day and are threatening the survival of mankind on the earth and pollution is one among them. Acetic acid is present in the effluent released from petroleum, fine chemical, pharmaceutical and textile industry. Adsorption by using various biosorbents is an attractive alternative to the conventional treatment technique for the removal of pollutants. Use of low cost absorbents is very important attribute because of which the research in this field has gained much importance. In this investigation the research is carried out to remove acetic acid using seeds of *Brassica Nigra*. The experimental data have been evaluated using Freundlich and Langmuir adsorption isotherm model. The linear plots obtained shows applicability of Freundlich and Langmuir isotherm.

***Keywords*:** Adsorption, Acetic Acid, *Brassica nigra*, Freundlich and Langmuir Isotherm

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Figure 1: Brassica nigra

Figure 2: seeds of Brassica nigra

I. INTRODUCTION

Environmental problems are growing day by day and are threatening the survival of mankind on earth. Pollution is one of them. Discharge of industrial waste water has increased, with rapid increase in population and growth of industrialization, quality of both surface and ground water is changing day by day. Acetic acid is one of the major pollutants in petroleum, fine chemicals, textiles and pharmaceutical industries. The various methods used to remove acetic acid includes adsorption, ion exchange, evaporation, precipitation and membrane techniques. Adsorption by using various adsorbents is also an attractive alternative. There is a need to find cheap and efficient methods for the treatment of industrial wastewater. The adsorption process is potential alternative to conventional treatment techniques for the removal of pollutants from the contaminated effluent. Activated carbon is the most widely used absorbent because of its excellent adsorption efficiency. Commercially available activated (charcoal) carbons are very expensive and restricts its use in developing countries. Use of low cost adsorbents is very important attribute because of which the research in this field has gained an importance.

The review of literature highlights the necessity of cost effective biosorbents. therefore usage of seeds of *Brassica nigra* (powder) as a precursor for the abatement of environmental pollution.

II. METHOD AND MATERIALS:

1. Preparation of Bio-Adsorbent:-

The seeds of *Brassica nigra* commonly called as mustard seeds taken from the local market & has been characterized & used as an inexpensive & effective adsorbent for the removal of acetic acid

from the waste water. The objective of the work is to develop a better method for the removal of acetic acid using low cost adsorbent. The seeds were washed, dried, crushed & powdered. The powder was sieved to get uniform particle size. It is stored in air tight bottle and used as it is for adsorption studies.

2. Preparation of solution:-

Stock solution of 0.5N acetic acid & 0.1N NaOH were prepared. Acetic acid various strengths of Acetic acid were prepared from 0.5N acetic acid. All chemicals used are of analytical grade.

3. Adsorption experiment:-Batch adsorption experiment 0.5N acetic acid adsorption by bio-adsorbent was carried out at room temperature by shaking a series of bottles each containing the desired quantity of the adsorbents in a predetermined concentration of acetic acid solution. The sample were withdrawn at different time intervals, the supernatant was separated by filtration and analyzed for remaining acetic acid content. The amount of acetic acid adsorbed from the solution was calculated by the following equation,

$$\frac{x}{m} = \frac{Ci-Ce}{20} \times \frac{1}{m}$$

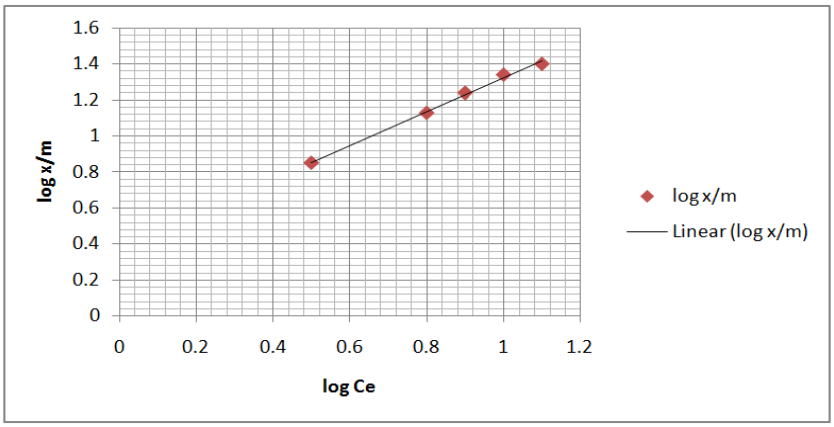
Where 'x' is amount of adsorption, 'm' is mass of the adsorbent, C_i is initial concentration of acetic acid, C_e is final concentration of acetic acid.

3.1 FREUNDLICH ADSORPTION ISOTHERM MODEL:-

Freundlich adsorption isotherm represents the relationship between the amount of acetic acid adsorbed per unit mass of the adsorbent x/m and C_e is the concentration of the acetic acid in solution at equilibrium. Freundlich equation can be described by the linearized form.

$$\text{Log } x/m = \log K_f + 1/n \log C_e$$

Where K_f & n are Freundlich constants. The values of K_f & n are determined graphically. A plot of log x/m Vs log C_e gives us straight line of slope 1/n and the intercept is log K_f.

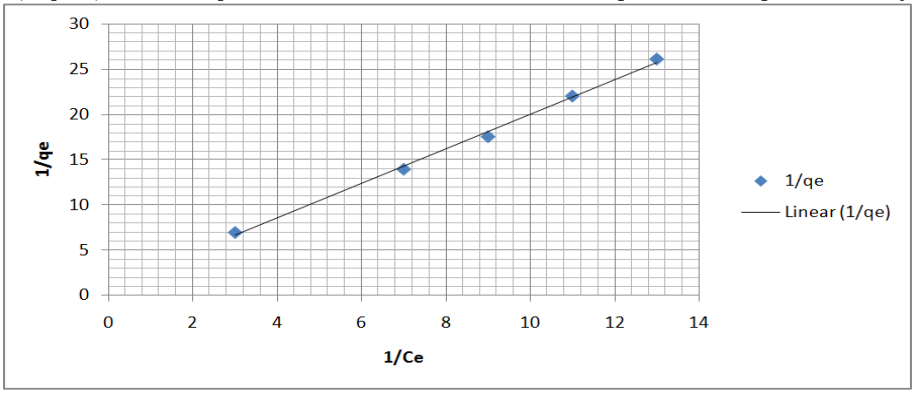


3.2 LANGMUIR ADSORPTION ISOTHERM MODEL:-

The Langmuir adsorption model is based on the assumption that the maximum adsorption corresponds to a saturated mono layer of solute molecules on the surface of the adsorbent. Langmuir equation can be described by the linearized form.

$$1/q_e = (1/q_m k_l)\ .\ 1/C_e + 1/q_m$$

Where C_e is the equilibrium concentration of acetic acid in solution (moles/lit). q_e is amount of acetic acid absorbed on adsorbent and q_m and k_l are mono layer adsorption capacity and Langmuir equilibrium constant which indicates the nature of adsorption respectively. A plot of 1/x/m or 1/qe Vs $1/C_e$ gives straight line of slope $1/q_m k_l$ and the intercept is $1/q_m$ which corresponds to complete monolayer coverage.



III. CONCLUSION

According to the results, it can be concluded the seeds of *Brassica nigra* (powder) was found to be the effective adsorbent for the removal of acetic acid from aqueous solution. From the Langmuir isotherm, the maximum adsorption capacity was calculated to be 0.96 mgg^{-1} of adsorbent. The findings of the study revealed that seeds of Brassica nigra (powder) is promising low cost adsorbent for the removal of acetic acid from contaminated waste water.

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