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Low Cost Agricultural Waste Adsorbent for COD Removal: Preliminary Investigation

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ABSTRACT

Chemical oxygen demand is measure of organic matter present in the wastewater. Organic matter present in the water consumes dissolved oxygen and it becomes harmful for aquatic life. Activated sludge process is most common method used for stabilization and removal of organic matter. Adsorption with low cost adsorbent is also effective method for removal of organic matter. In the current research groundnut shell activated carbon is used for organic matter removal from wastewater. Effects of various parameters like initial concentration, pH, adsorbent dose and contact time on COD removal are studied. Also the data is tested for Freundlich and Langmuir isotherms.

Keywords: Organic Matter, COD, Concentration, pH, Adsorbent.

I. INTRODUCTION

Water treatment plants for industrial and domestic wastewater contain primary, secondary and tertiary treatment facilities. Primary treatment contains screening, bar racks and primary settling. Secondary treatment is biological treatment and tertiary treatment techniques are chemical and/or advanced treatments [1-5]. Advanced oxidation methods are used for efficient operation. In this method hydrogen peroxide can be used as an oxidizing agent [6,7]. Adsorption is one the most commonly used method for COD removal or removal of specific pollutant from wastewater [8-11]. Many low cost adsorbents are used for removing organic matter from wastewater. In the current investigation, groundnut shell activated carbon is used for removal of organic matter from wastewater. Effects of various parameters like initial concentration, pH, adsorbent dose and contact time on COD removal are studied. Also the data is tested for Freundlich and Langmuir isotherms.

II. METHODOLOGY

Groundnut shells obtained from the farm at Salgar Budruk Tal. Mangalwedha , Dist. Solapur were first washed with water. Then crushed and washed with dilute acid. Again washed with water and carbonized at 400 degree Celsius. The particle size more than 36 mesh size was used as literature indicates that slurry formation and other undesired effects occur at lower particle size. COD value were varied by appropriate dilution. Experiments were conducted at initial concentrations of 1000, 500, 250, 100 and 50 mg/l COD. Also experiments were conducted at various pH values with optimum initial concentration. Then at optimum value of initial concentration and pH, experiments were conducted at various adsorbent dosages. At the end of all batch experiments we get optimum value of all these parameters. The batch experimental data was tested for Freundlich and Langmuir isotherms.

III. RESULT AND DISCUSSION

COD Variations at various initial concentrations

As shown in fig.1, the at higher initial concentration, initially very fast rate of adsorption was obtained. After 1 hour the rate became stable. The final concentration achieved was 200 mg/l. approximately 80 percent COD removal was observed. 1 hour of contact time was enough for 100 ml of effluent with initial concentration of 1000 mg/l. With decrease in the initial concentration to 500,250,100 and 50 mg/l, there was slight decrease in percentage removal by 1-3 percent. Also optimum time reduced by 2,5 and 10 and 15 minutes respectively for these concentration.

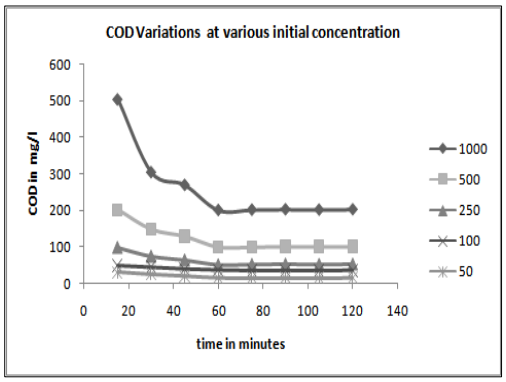

Figure 1: COD Variations at various initial concentration

COD variation at various pH values

It was observed that the COD removal was maximum at pH value 7. The acidic pH affects the organic matter removal adversely. Also Increase in pH above 7 doesn't have any favourable effect. Therefore pH value of 7 is considered as optimum for COD removal from wastewater. Effect of pH on outlet COD is indicated in Fig.2.

COD Variation at various adsorbent dosages

As shown in fig.3, for increase in the adsorbent dosage from 1 to 3 gram per litre, there was increase in COD removal from 89 percent to 93 percent. Further increase in COD had slightly negative effect on the COD removal. The adsorbent dose of 3 gram per 100 ml is considered as optimum for COD removal.

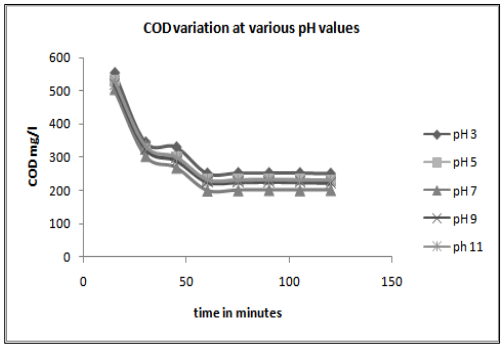

Figure 2: COD variation at various pH values

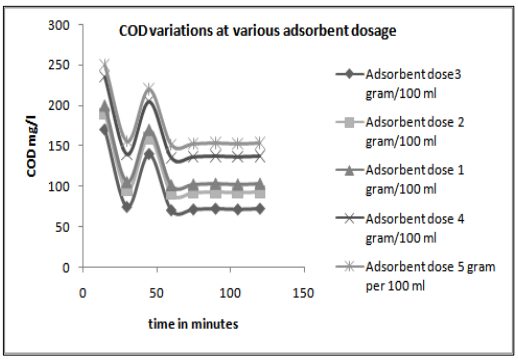

Figure 3: COD Variation at various adsorbent dosages

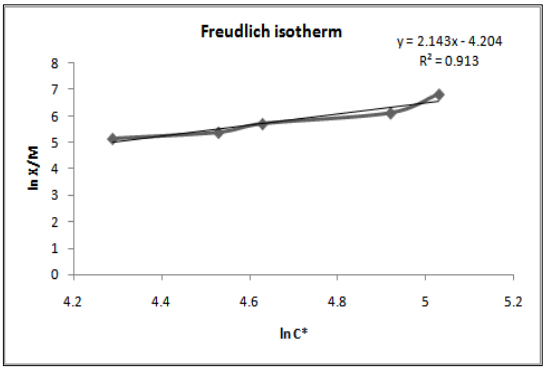

Figure 4: Freundlich isotherm

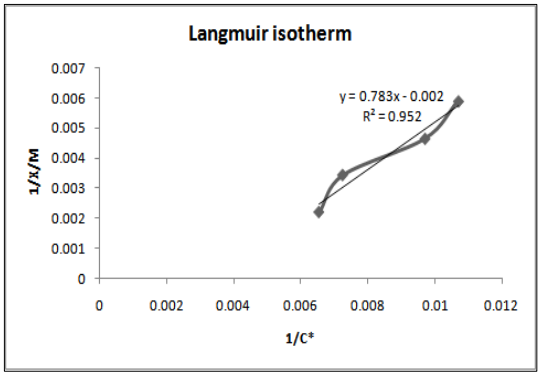

Figure 5: Langmuir isotherm

IV. ISOTHERMS

The batch experimental data was tested for Freundlich and Langmuir isotherms. It was observed that the adsorption followed the Freundlich isotherm reasonably well with R^2 value more than 0.9. It also observed that Langmuir isotherm explained the adsorption better than the Freundlich isotherm with R^2 value more than 0.95.Freundlich and Langmuir isotherms are depicted in fig.4 and 5 respectively.

V. CONCLUSION

Approximately 80 percent COD removal was observed. 1 hour of contact time was enough for 100 ml of effluent with initial concentration of 1000 mg/l. With decrease in the initial concentration to 500,250,100 and 50 mg/l, there was slight decrease in percentage removal by 1-3 percent. Also optimum time reduced by 2,5 and 10 and 15 minutes respectively for these concentration. It was observed that the COD removal was maximum at pH value 7. The adsorbent dose of 3 gram per 100 ml is considered as optimum for COD removal. that Langmuir isotherm explained the adsorption better than the Freundlich isotherm with R^2 value more than 0.95.

VI. REFERENCES

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