



ACTIVATED CHARCOAL PREPARED FROM AGRICULTURAL WASTES

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ABSTRACT

Activated charcoal have been prepared from the agricultural wastes of *Glycine max* using chemical activating agents such as zinc chloride and orthophosphoric acid. The activated charcoal prepared from *Glycine max* have shown that the charcoal have a good uptake capacity for acetic acid and oxalic acid. The adsorption studies also show that p-chlorophenol is adsorbed on activated charcoal. The present study reveals the recovery of valuable adsorbents from readily and cheaply available agricultural wastes from *Glycine max*. The study of Longmuir adsorption isotherm is also carried out for all carbon samples. The activated charcoal is also useful for the adsorption of other toxic materials.

Key words: Charcoal, Adsorption, *Glycine max*.

INTRODUCTION

In Maharashtra the crops grapes, maize, cotton, wheat, bajra, bengal gram and *Glycine max* are harvested. Agricultural wastes from the crops are available in large amount. This waste can be carbonized. Effectiveness of carbonization is enhanced, when the sources are impregnated with metallic salts like calcium chloride or zinc chloride. In the last two decades, a growing interest has been focused the use of phosphoric acid as an activating agent in the production of activated carbon from both; mineral and botanical sources.¹⁻⁷ In a chemical activation process, the lignocellulosic precursor is mixed with a chemical, after carbonization and washing, the final activated carbon is produced.¹⁻¹⁰

The presence of incorporated phosphoric acid brings about a shift in the decomposition temperature (300°C) that prevents the burnout of charcoal and raises its yield. It is thus demonstrated that the temperature (800°C) is suitable for the production of activated carbon. In the present work, activated carbon has been prepared by using 10 %

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ZnCl₂ and 20 % H₃PO₄ as activated agents. Before studying the removal of metal ions, phenols, which are industrial wastes, it was thought appropriate to study the adsorption kinetics for acids such as oxalic acid and acetic acid.

EXPERIMENTAL

The activated charcoal was prepared by carbonizing the weighed stalks of *Glycine max*. Completion of procedure was detected by the back suck of water from side arm tube, which was placed in a beaker. The activated charcoal was dipped in a 10 % ZnCl₂ solution and kept for 24 hr, filtered through Whatman paper No. 41 and washed with 2N HCl to remove zinc and washed with water till washing shows pH = 7. The charcoal (C_{zn}), thus prepared, was passed through sieves to get particles of uniform size (53 micron).

Small pieces of *Glycine max* stalks were weighed and dipped in 20 % H₃PO₄ for 24 hr. Stalks are removed and dried in an oven at 100°C, kept in a furnace for 2 hr. at 850°C.

The charcoal was washed with distilled water to make pH = 6-6.5. The charcoal (C_{ph}) was passed through sieves to get particles of uniform size (63 micron). Samples used for adsorption study of acetic acid were C_{zn} and C_{pH}. Samples used for adsorption study of oxalic acid were C_{zn}.

Adsorption study was carried out by reported literature procedure¹¹.

RESULTS AND DISCUSSION

The plots of Ce/(x/m) against Ce (Fig. 1 and 2) for all the above mentioned samples were found to be linear, indicating applicability of the Langmuir equation.

$C/(x/m) = 1/ab + (1/b) C$. A comparison of adsorption capacity of the different charcoal samples (C_{zn} and C_{pH}) is found to be comparable with the adsorption capacity of animal charcoal. The data for adsorption of acetic acid on C_{zn} and C_{pH} show that concentration 0.3 to 0.5 moles/L is the best suited concentration at room temperature. (Table 1).

Table 1. Adsorption capacity of activated charcoal (AC), C_{zn} and C_{pH} for acetic acid

C_0 (moles/L)	x/m for AC (moles/L)	x/m for C_{zn} (moles/L)	x/m for C_{pH} (moles/L)
0.1	0.092	0.091	0.080
0.2	0.110	0.108	0.106
0.3	0.130	0.134	0.131
0.4	0.170	0.126	0.169
0.5	0.210	0.118	0.152
0.6	0.242	0.102	0.140

Table 2. Adsorption capacity of C_{zn} and C_{pH} for oxalic acid at 26°C

Initial concentration (C_0)(moles/L)	x/m for C_{zn} (moles. g/L)	x/m for C_{pH} (moles. g/L)
0.1	0.0191	0.0251
0.2	0.0211	0.0290
0.3	0.0340	0.0370
0.4	0.0460	0.0471
0.5	0.0315	0.0405
0.6	0.0235	0.0312

A plot of initial concentration of oxalic acid (C_0) against adsorption capacity (x/m) of C_{zn} at 35°C indicates that 0.4 moles/L is the best suited concentration for adsorption on C_{zn} (Fig. 4).

Adsorption studies of p-chlorophenol have also given encouraging results. Plot of concentration of p-chlorophenol at 225 nm wavelength against absorbance is shown in Fig. 5.

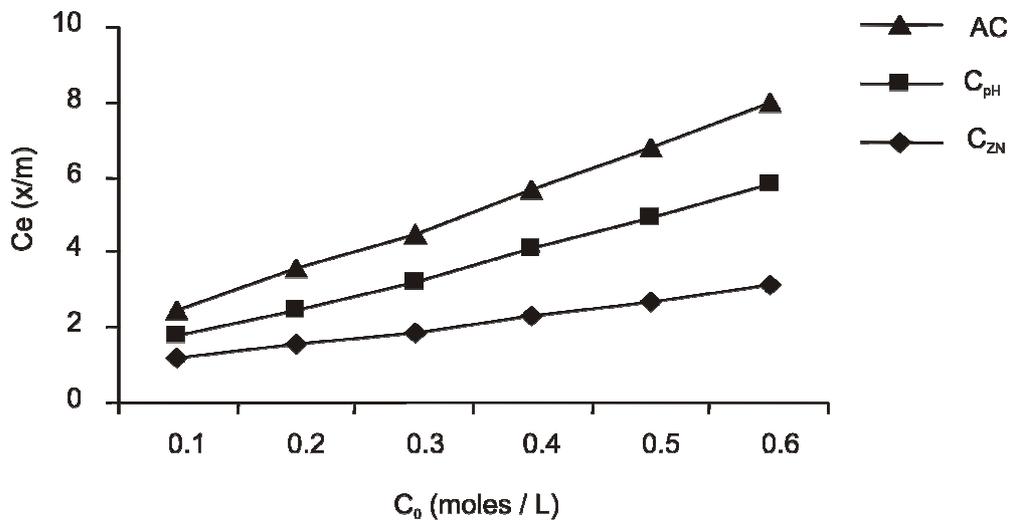


Fig. 1: Adsorption isotherm for oxalic acid on AC, C_{Zn} and C_{pH}

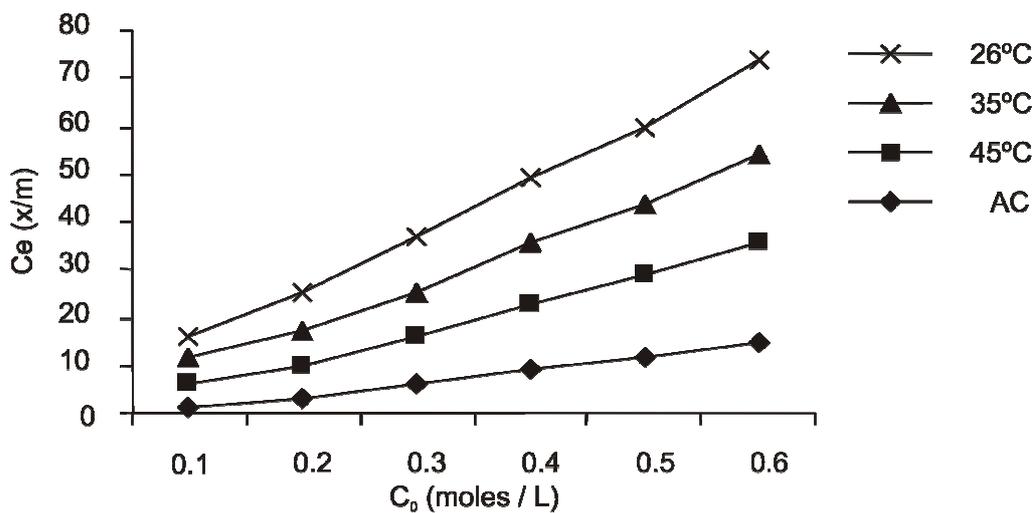


Fig. 2: Adsorption isotherm for oxalic acid on AC, C_{Zn} and C_{pH}

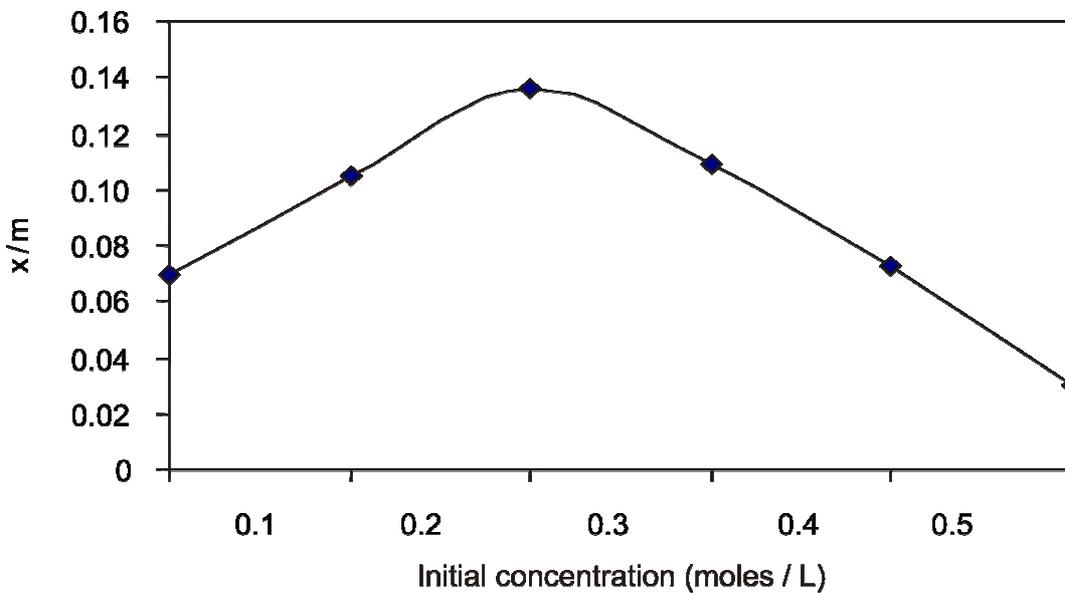


Fig. 3: Adsorption isotherm for oxalic acid on AC, CZn and CpH

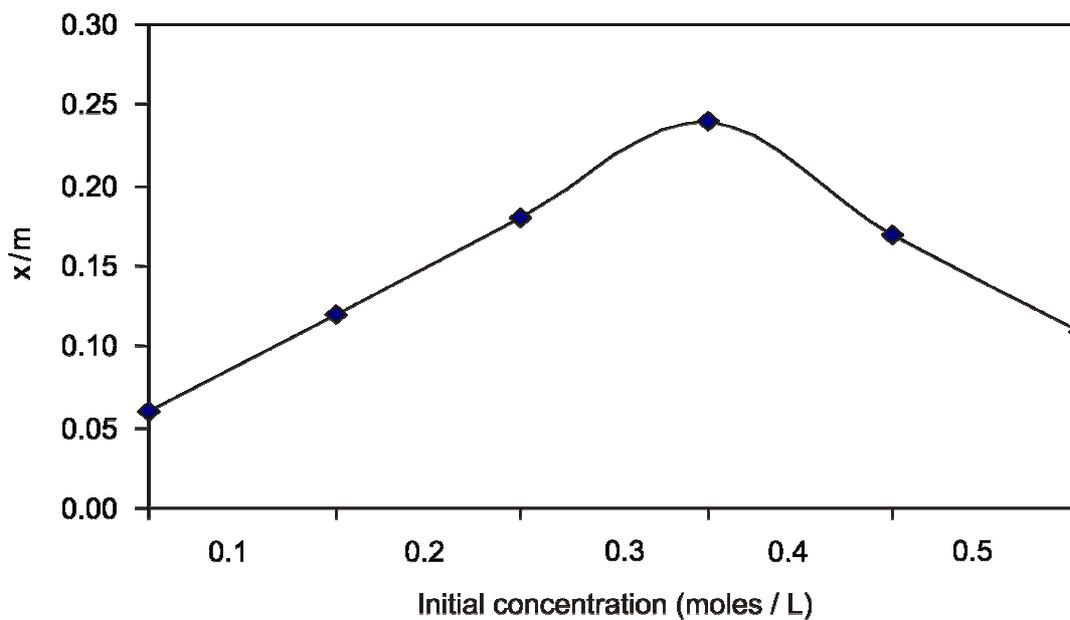


Fig. 4: Adsorption isotherm for oxalic acid on AC, CZn and CpH

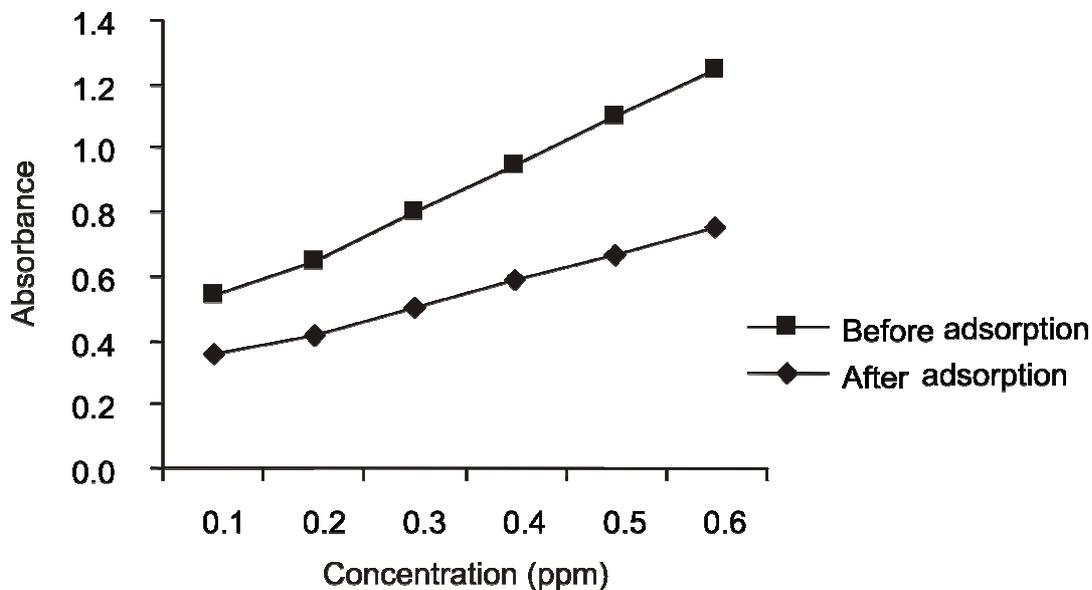


Fig. 5: Adsorption isotherm for oxalic acid on AC, C_{Zn} and C_{pH}

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