Removal of Colour Component from Waste Water by the Adsorbent Prepared from Waste Material

P. P. Chahande and M. P. Patil
Department of Chemistry, SevadalMahilaMahavidyalaya, Nagpur-440009 (M.S.)
praffulchahande@gmail.com

Abstract:

Activated carbon is made from various agricultural waste by physical and chemical activation. The preparation of activated carbon from waste material could increase economic return and also provide an excellent method for solid waste disposal, thereby reducing pollution. The adsorption of potassium permanganate on prepared activated carbon was investigated. Freundlich and Langmuir adsorption were studied. The result indicates that it can act as a good adsorbent.

Keywords: Activated carbon, peanut shells, adsorption.

Introduction:

Activated carbon has long been recognized as one of the most versatile adsorbents to be used for effective removed of low concentrations of organic compounds from aqueous solutions. The activation of carbon provides it with many of its useful properties[1]. Nowadays interest is growing in the use of other low cost and abundantly available agricultural and other waste. In tropical countries a vast variety of fruit and agricultural wastes are likely precursors for the manufacturing of activated carbon from maize cob, almonds shells, ground nut husk, palm seed coat etc. It was found that colour removed by activated carbon is upto 94%. Activated carbon has long been recognized as one of the most versatile adsorbents to be used for the effective removal of low concentration of organic compounds from aqueous solutions. The activation of carbon provides it with many of it's useful properties and degree of activation affects it's physical and chemical properties. It was found that the color removal by coir pith carbon was 94% which is comparable with commercial activated carbon (90%) at pH 8.6[2]. The dyes are harmful to all living [organisms] systems polluting water and soil. The uptake of dyes from wastewater using adsorption was reported in literature[3].

Adsorption is one of the techniques that would be comparatively more useful and economical. Several adsorption methods have been developed and tested ranging from low cost waste material such as moss peat[4], hazelnut shell[5], rice husk carbon[6] to more sophisticated adsorbents such as modified clay[7], modified steel slag[8], nanoscale magnetic material[9]. Many methods have been reported for the carbonization and activation of waste organic material and these are adequately covered in the text by Hassler[10]. India is producing peanut on large scale. During use the shells are removed as a solid waste. The abundant and easily available solid waste material peanut shells can be converted to an effective low cost adsorbent to remove colour from waste water.

Experimental Method:

Activated carbon was prepared from peanut shells. Peanut shells were collected, washed, dried. It was crushed and roasted. Then it was kept in

25%calcium chloride solution overnight. Later on it was washed several times with distilled water and dried. Adsorption of oxalic acid on activated carbon was studied from which Freundlich and Langmuir adsorption was verified. Six stopper bottles were prepared as mentioned in observation table. After shaking for one hour it was filtered. 10ml of filtrate was titrated against standard alkali (0.05N).

Observation:

Freundlich adsorption can be written as $x/m = KC^{1/n}$

where x = the amount of adsorbate by m adsorbent,

C = Equilibrium conc. of adsorbate.

K and n are constants.

$$\log x/m = \log K + 1/n \log C$$

Plot log x/m versus log C. If it gives a straight line with slope equal to log K, Freundlich adsorption isotherm was verified.

Langmuir adsorption isotherm:

Langmuir adsorption isotherm assumes a unimolecular layer adsorption on the surface of adsorbsent.

For solution the isotherm is $x/m = \dfrac{K_1 K_2}{1 + KC}$

where x is the mass of solute adsorbed on mass m of adsorbent and K are constants.

$$\frac{C}{x/m} = \frac{1}{K_1} + \frac{1}{K_2 K_2}$$

A straight line plot of 1/c versus $1/x/m$ confirms Langmuir adsorption isotherm.

Table.1-

Bottle. No	Wt.of Charcoal (gm)	Acid + Water	Vol.of NaOH Before Adsorption For 10ml (A)	Vol. of NaoH After Adsorption For 10ml (C)	Amount of acid Adsorbed In Terms of NaoH (x)=A-C	x/m	Log x/m	log C	1/ x/m	1/C
1	1	50+0	20	9.3	10.7	10.7	1.0293	0.9684	0.0934	0.1075
2	1	40+10	16	12.5	3.5	3.5	0.5440	1.0969	0.22857	0.0800
3	1	30+20	12	8.3	3.7	3.7	0.5682	0.9190	0.2702	0.1204
4	1	20+30	8	7.8	0.2	0.2	0.698	0.8920	5.000	0.1282
5	1	10+40	4	1.6	2.4	2.4	0.3802	0.2041	0.4166	0.625
6	1	5+45	2	0.3	1.7	1.7	0.2304	0.5228	0.5882	3.333

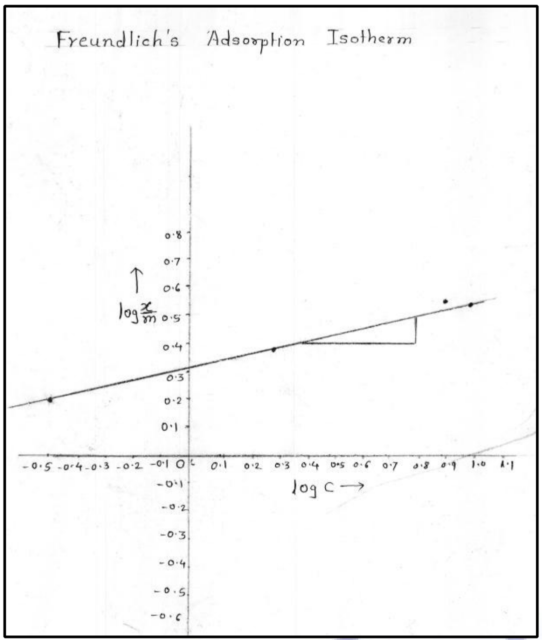

Figure. 1

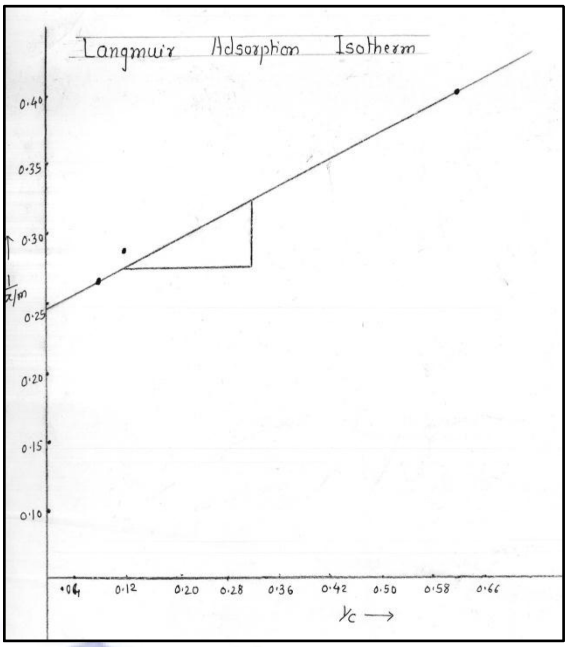

Figure. 2

Result and Discussion:

The graph of log x/m versus log C was plotted. The graph was straight line with slope 0.20, intercept 0.32 and the value of K was found to be 2.08. Freundlich adsorption isotherm was verified. The graph of 1/x/m versus 1/c was plotted. The graph was straight line with slope 2.77, intercept 0.24 and the value k_1=11.33 and k_2=0.36. Thus Langmuir adsorption isotherm was verifieds. Thus activated charcoal prepared from waste peanut shells can act as adsorbent.

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