CARBON MOLECULAR SIEVES FROM ACIDIFIED COCONUT SHELL CHAR

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Introduction

A sustained interest in the area of microporous adsorbents for specific separations has led to the development of a special class of porous material known as Carbon Molecular Sieves (CMS) which are essentially Carbon based substances. Total neutrality, in acid and base media, high temp stability, very low hydrophillicity, molecular sieving ability and overall low cost of production have made CMS a potential end product for precise separations of gas mixtures as well as liquid mixtures at moderate conditions of temperature and pressure.

Experimental Investigations

Experimental part is divided into three major parts, (i) Preparation of CMS from coconut shell, (ii) Adsorption studies of gases like N_2, O_2, CH_4, C_2H_2 and CO_2, on the CMS prepared and charecterisatuon of some of the representative samples in terms of its S_{N2}, S_{CO2}, kinetic adsorption curves etc.

Washed dried and crushed coconut shell was carbonized at 850 ^{0} C, in presence of nitrogen for 30minutes. Activation of the char was done for 30 minutes in presence of CO_2 at 600 ^{0} C.

The activated char was refluxed wih 1% hydrochloric acid, 1% nitric acid and also with o.4 % hydroflouric acid for a time range 10-180 minutes. The acidified char was then subjected to benzene cracking at 600 ^{0} C for different intervals of time varying from 30 to 120 minutes.

Results and Discussion

Nine samples were prepared - HC-C1 to 3 ; HN-C1 to 3 and HF - C1 to 3. Table 1 gives the cracking time and the respective S_{CO2}.

Table 1.
Surface area of the Various CMS samples

Sample code	Cracking time min.	S_{CO2} m^2/g
HC-C1	30	212
HC-C2	45	250
HC-C3	120	280
HN-C1	30	230
HN-C2	45	242
HN-C3	120	258
HF-C1	30	335
HF-C2	45	380
HF-C3	120	412

Kinetic adsorption curves obtained for nitrogen and oxygen on all the samples show that HF is better acidifieng agent to generate active centres for cracking compared to HCL and HNO_3. The uptake ratio for oxygen to nitrogen adsorption is tabulated in Table 2. The uptake ratio of samples HF-C2 to 3 is found to be very much comparable with the available commercial CMS samples which is between 10 - 12mg/g of CMS.

Table2. Uptake Ratios for O_2 /N_2 adsorption.

Sample code	Adsorpion of O_2	N_2	Uptake Ratio
	mg/g of CMS		
HC-C1	2.85	1.14	2.5
HC-C3	3.17	1.14	2.8
HN-C1	2.15	1.80	1.2
HN-C3	2.55	1.51	1.7
HF-C1	4.95	1.0	5.0
HF-C2	5.95	0.91	6.5
HF-C3	6.12	0.63	9.7

Adsorption of hydrocarbons like acetylene and methane was found to be very poor in all the samples. The methane molecule being very small is not showing any adsorption on these samples. The slight polarity as well as the linear structure of acetylene molecule restricts the adsorption of the same on these samples.

Conclusions

Based on the experiments conducted, the following conclusions are drawn.

1. CMS have several remarkable features by virtue of which they are gaining increasing importance as adsorbents in separation process.

2. The fact that their pore dimensions can be tailored to any desirable value is of great importance as it provide for high sterio specificity between the molecules of very similar dimensions.

3. Hydrofluric acid is a good acidifieng agent to generate acid centres for cracking of benzene.

4. By controlling the acidifieng as well as cracking time good CMS for separating nitrogen from air could be prepared.

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