EFFECT OF SOLVENT PRESWELLING OF COAL IN THE DEVELOP OF HIGH SURFACE CARBONS

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INTRODUCTION

Micropores activated carbons are of commercial interest. Recent studies show that the demand for activated carbon will increase 5% per year due especially to the demand by the environmental regulations and the efficacy of activated carbon in water treatment systems. The fastest growth, will come in activated carbons use in emission canister (1). The activation is normally done by carbon dioxide or by chemical heat treatment from different feedstocks. The solvent preswelling of coal increases the porosity of coal, making the swelled coal more accessible to the reactants (2).(3), so the contact between the chemical and the active site increases and may have beneficial effect on the surface area development. The objective of the present paper is to study the influence of solvent preswelling of coal in the chemical activation with KOH.

EXPERIMENTAL

Two non caking coal, Cerrejón (Ce, Colombia) and Saarkohle (Se, Germany) were crushed to less than 250μ and swollen with butylamine at room temperature according to the procedure described before (3).

The activation was done by impregnation using KOH to incipient wetness (wt% coal:KOH =1) and subsequent heat treatment in inert gas to 850°C at different residence time. After cooling the KOH was washed with deionized water and dry under vacuum. All activated carbons were characterized by N_2 adsorption at 77K and mercury porosimeter.

RESULTS AND DISCUSSION

The analytical data of the coal used are presented in table 1,

Table 1. Analytical data of the coals

Sample	Proximate			Ultimate				Q
	V.M.	Ash	Moisture	C	H	N	S	
Ce	43.0	6.0	3.0	82.0	6.0	2.0	1.0	2.10
Se	40.0	10.0	2.0	83.0	6.0	1.0	1.0	2.14

Where Q, volumetric swelling index; V.M, Volatile matter

The two samples are of similar rank, as shown by the analytical data, and its behavior in the swelling index is also similar. The main difference is due to geological formation. The Ce belong to Cretaceous origin while Se comes from the carboniferous age.

Representative nitrogen isotherms obtained with the microporous carbons are shown in figure 1. Table 2 shows the specific surface area (BET) and the total pore volume of the activated carbons at different burn-off, obtained by different Heat Treatment time at 1, 2 and 7 hours at the final residence time respectively.

All the carbons obtained may be classified as activated carbons. The micropore structure, shown by the isotherm is of high microporosity. In Ce the burn-off increases the surface, but when swelling the highest surfaces area is developed at 30% of burn-off and then decreases. However this behavior is not the same with Se coal. The maximum specific surface in Se, is obtained in the preswollen coal and 70% burn- off..

Table 2. Surface area at different burn-off

Sample	Burn-off	Area (BET) cm^3/-g	T.P.V cm^3/g
Ce	30%	673	0.35
	50%	863	0.47
	70%	875	0.45
CeS	30%	1123	0.58
	50%	950	0.49
	70%	634	0.33
Se	30%	678	0.35
	50%	960	0.49
	70%	702	0.37
SeS	30%	934	0.49
	50%	1042	0.54
	70%	1314	0.68

Where: CeS, Cerrejón swollen coal; SeS, Saarkohle swollen coal; T.P.V, total pore volume.

The main effect of solvent swelling of coal, observed in this work, was to increase the surface area and to develop a wider micropore structure .

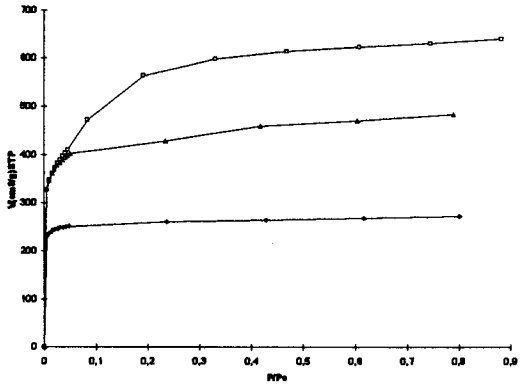

Figure 1, adsorption isotherms on microporous carbons. □ SeS, Saarkohle swollen coal burn-off 70% ; Δ CeS, Cerrejón swollen coal burn-off 30%, ♦ Ce, Cerrejón coal burn-off 70%

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