PREPARATION AND PROPERTIES OF PHENOLIC RESIN-BASED SPHERICAL ACTIVATED CARBON BY ADDING PEC

Junbing Yang **Licheng Ling* **Yanzhen Fan* *Lang Liu*
Institute of Coal Chemistry, Chinese Adademy of Siciences,
P.O. Box 165, Taiyuan, Shanxi, China 030001
**State Key Laboratory, Institute of Coal Chemistry, Chinese Adademy of Siciences,*
P.O. Box 165, Taiyuan, Shanxi, China 030001

Introduction

The present authors developed a phenolic resin-based spherical activated carbon (PHSAC) which contains mainly micropore[1~3].Because the less porosity after carbonization, the activated carbon sphere has small surface area. We currently report a method to modify this phenomenon.

Experimental

The phenolic resin used was a novolac-type phenolic resin with a softening point of 95~105℃. The curing agent was hexamethylenetetramine(hexa). The pore former which decomposed without residue carbon by heat-treatment was polyethylene glycol(PEG). The solvent was methanol.

Prefixed amounts of novolac-type phenolic resin were mixed with PEG and hexa in methanol intimately. After removal of methanol under reduced pressure, the mixture was pulverized to irregular particles and then the irregular particles were feed into a high-pressure reactor in which contains emulsion liquid composed of water and lauryl sodium sulfate. when the emulsion liquid was heated up to 125 ℃by the rate of 2℃/min, the irregular particles were sphericized. The resulting phenolic resin spheres were then carbonized at 800℃ for 30 min under a nitrogen stream and then activated at the same temperature for 90 min under a stream of steam. In this work, two kinds of PHSAC were prepared, one is PHSAC with PEG content of 18wt % (p_1), the other is PHSAC without PEG (p_0) as a reference.

BET specific surface area was determined from the isotherm of N_2 at 77K[4], pore size distribution was obtained using BJH method[5], micropore volume was obtained using DR equation[4].

Results and Discussion

Table 1 shows the comparison of p_0 and p_1 after carbonization and activation. p_1 has less yield both after carbonization and activation, but the BET specific surface area and DR micropore volume are higher than p_0. It can safely be said that by adding PEG phenolic resin carbon spheres had higher porosity than without PEG, so it could easily be activated to get high specific surface area and micropore volume.

Fig.1 shows the pore size distribution of p_0 and p_1 using BJH method. It is clear that p_1 has higher pore volume than p_0 throughout the total pore size range. One interesting thing is that at 3~5nm, there is a peak appears in p_1. It indicates that the pore size distribution of PHSAC can be changed by adding PEG.

Conclutions

Phenolic resin-based spherical activated carbon was prepared successfully by adding PEG. The phenolic resin carbon spheres with PEG have high porosity and so they can be easily activated to get high specific surface area and micropore volume. The pore size distribution of phenolic resin-based spherical activated carbon can be changed by adding PEG.

References

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Table 1. comparison of p_0 and p_1 after carbonization and activation

	P0	P1
Yield after carbonization(%)	63.59	51.47
Yield after activation at 800 ℃ for 90 min(%)	84.21	58.62
BET specific surface area(m^2/g)	545	904
DR micropore volume(cm^3/g)	0.25	0.37

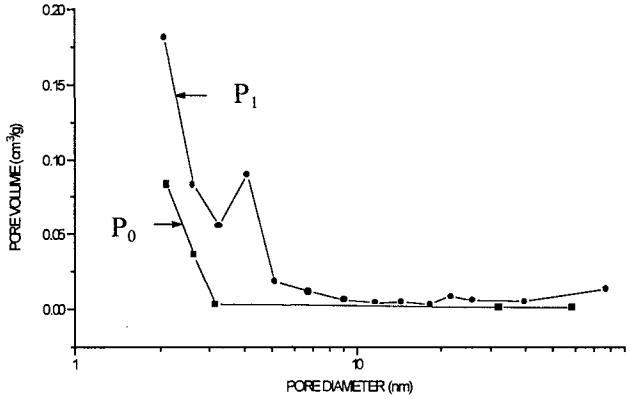

Fig. 1 pore size distribution of p_0 and p_1 using BJH method