은도금 활성탄소의 제조 및 기공구조 분석

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Preparation and Structural Characterization of Silver-Deposited Activated Carbons

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1. Introduction

Activated carbons (ACs) are widely used in adsorption for the removal of gaseous and aqueous pollutants[1,2]. The microbicidal property of ACs is also very important, in order to decrease the risk of water and air contamination with microorganisms. For this purpose, ACs have impregnated with silver or with metallic oxides[2]. However, in the case of Ag supported ACs prepared by impregnation, there are some problem, such as, heat-treatment, highly decrease in specific surface area and pore volume by deposited Ag, and rapidly elution of Ag at the initial stage of usage[3].

In this work, silver-deposited ACs are prepared by impregnation in HCl and $AgNO_3$ solutions to increase the attrition of silver on carbon surface and the effect of the silver content on the structural properties of the resulting ACs is studied.

2. Experimental

2.1. Materials and sample preparation

Activated carbons supplied by DongYang Carbon Co. were used. $AgNO_3$ having different concentration (0, 1, 3, 5, and 7 mg/L) was applied to the source of silver in this work. ACs were, in turn, impregnated in $AgNO_3$ and HCl solutions in a thermostatic bath and stirring. The treated ACs were washed with distilled water and acetone to remove residual silver thoroughly, and then dried at 110℃ for 24 h. For ease of comparison, the ACs studied were identified as AR, 1, 3, 5, and 7 according to the silver concentration.

2.2. Characterization

Nitrogen adsorption isotherms were measured using an ASAP 2010 (Micromeritics) at 77K. The amount of nitrogen adsorbed on ACs was used to calculate specific surface area by means of the BET's equation and total pore volume. The content of silver was determined by inductively coupled plasma-atomic emission spectrometer (ICP-AES, Jobin-Yvon Ultima C). Also, the types of silver in carbon samples were examined by X-ray diffraction measurement (XRD, Model D/MAX-III B).

3. Results and discussion

3.1. Nitrogen adsorption isotherms

The nitrogen adsorption isotherms of the ACs treated at different $AgNO_3$ concentrations are shown in Figure 1. The adsorption isotherms of all samples are approximately the Type I isotherm according to the BET's classification. Also, it can be seen that the adsorption capacities of the ACs studied increase as the concentration of silver solution increases. These adsorption behaviors indicate that the formation of new pores between silvers on the resulting carbons is caused by the deposition of silver. In Figure 2, XRD patterns of the ACs studied are shown. As shown in Figure 2, the diffraction peaks corresponding to Ag and AgCl appear in the case of $AgNO_3$-treated samples. Meanwhile, no diffraction peaks are observed in the case of AR.

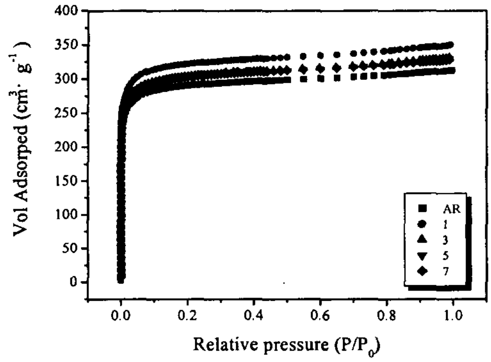

Figure 1. Nitrogen adsorption isotherms of the studied ACs.

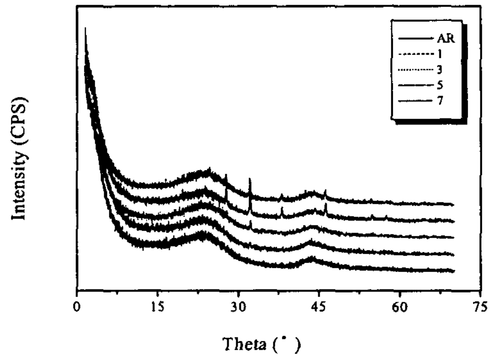

Figure 2. XRD patterns of the studied ACs.

3.2. Structural parameters

Table 1 summarizes the structural parameters and content of silver on the resulting carbons. The data show that both BET surface area and total pore volume increase with increasing the concentration of silver. It implies that the deposition of silver rarely influence on the structural properties and result in the formation of new micropore.

Table 1. Structural parameters and content of Ag

Nomemclature	S_{BET} (m^2/g)	V_{Total} (cc/g)	Content of Ag (ppm/g)
AR	1212	0.48	0
1	1284	0.51	25
3	1214	0.48	62
5	1204	0.47	115
7	1211	0.48	160

4. References

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