TREATMENT OF BASIC DYE WASTES WITH ACTIVATED CARBON FABRICS

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INTRODUCTION

Activated carbon fibers in a tow, fabric or felt form have received increasing attention in recent years as an adsorbent, filter, and the like, for filtering automobile gasoline, deodorizing tobacco smoke, recovering a solvent, purifying water, etc. Activated carbon fiber is produced by carbonizing a raw material such as polyacrylonitrile (PAN) fiber, cellulosic fiber, phenol resin fiber, or pitch fiber and subsequently activating the carbonized fiber. The activation process is carried out at a temperature from 700° to 1000°C in an atmosphere of steam, carbon dioxide gas, and so on.

In our previous studies[1-5], we reported on the changes in the morphology, microstructure, physical properties, and dynamic mechanical properties for PAN precursors during the stabilization process. The main objective of the research was to investigate the removal of basic dye (Basic blue 69) by the three fabrics. Tests were also carried out for the removal of methylene blue.

EXPERIMENTAL

Batch tests were performed in this study. The samples of Fabric A (cellulose-based activated carbon fibers, USSR), Fabric B (phenolic resin-based activated carbon fibers, Japan) and Fabric C (PAN-based activated carbon fibers, made in our lab.) were placed in a series of 500ml stoppered glass conical flasks.

Dye and methylene blue adsorption studies was carried out by dynamic process. A known quantity of activated carbon fabrics were immersed in a known volume of basic dye (Basic blue 69) solution from 0.5 to 36 h. The amount of dye and methylene blue adsorbed was determined by the concentration difference before and after immersion in the solution. The dye and methylene blue concentration of the collected samples were determined with a UV spectrophotometer at a wavelength of 590 and 666 nm. The wavelength was also used to prepare a calibration curve from known dye and methylene blue concentrations. The adsorption capacity was expressed in terms of the milligram of dye and methylene blue adsorbed in activated carbon fabrics per gram.

Surface area of the activated carbon fibers was measured by the nitrogen adsorption method (BET) using an Micromeritics Surface Area Analyzer Model ASAP 2000 manufactured by Micromertrics Instrument cooperation.

RESULTS AND DISCUSSION

The surface area, obtained from the BET and t-plot methods of nitrogen for all activated carbon fabrics are shown in Table 1. Fabric C has a greater

Table 1 Surface area (m^2/g) of three activated carbon fabrics

	Micropore area	External surface area	Total surface area
Fabric A	975	318	1293
Fabric B	1614	244	1858
Fabric C	384	735	1119

external surface than samples A and C. This finding indicates that Fabric C has more mesopores than samples A and C.

The results of methylene blue adsorption of the activated carbon fabrics are shown in Figure 1. The adsorbed amount of methylene blue for all activated carbon fabrics increases with the increase in the immersion time. The adsorbed amount of methylene blue ranging from 360 to 381 mg/g is present when the immersion time is long to 36h.

Figure 2 shows the adsorbed amount of basic dye for all activated for Fabrics A, B, and C were about 396, 299, and 399 mg/g. Fabrics A and C showed a excellent adsorption capacity. This indicated that Fabric A has not only small pores but also relatively large pores while Fabric B has only small pores. Fabric C has large mesopores. Therefore, this sample adsorbed almost basic dye from water. It has been reported that to absorb color bodies pores ranges of activated carbons sizing from 2 to 50 nm are required[6]. Because Fabrics A and C have a greater pore volume than Fabric B, these samples have a greater adsorbed amount than the other.

Acknowledgments

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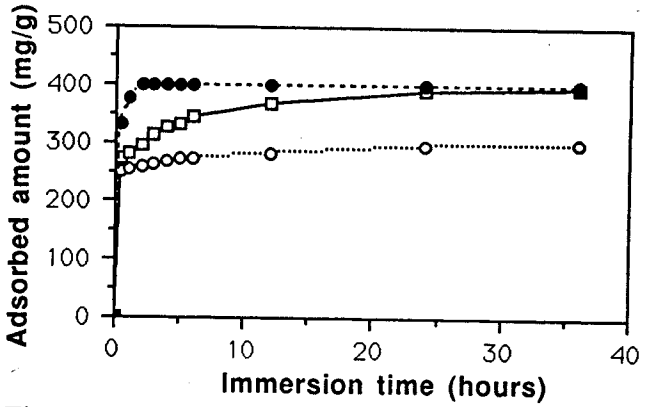

Figure 1 Immersion time dependence of the methylene blue adsorbed amount of activated carbon fabrics: (□) Fabric A; (○) Fabric B; (●) Fabric C.

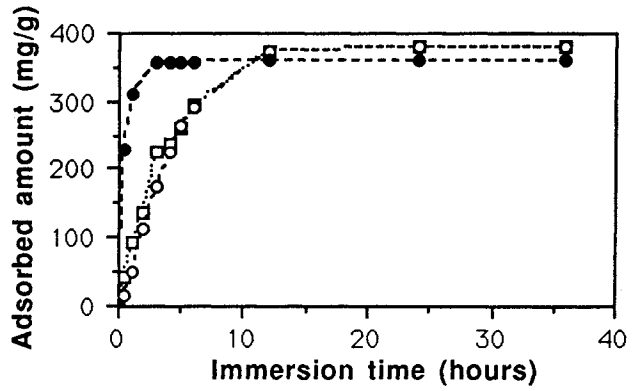

Figure 2 Immersion time dependence of the basic dye adsorbed amount of activated carbon fabrics: (□) Fabric A; (○) Fabric B; (●) Fabric C.