Effects of surface functional groups of activated carbon fibers modified by nitric acid on propylamine adsorption

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Amines such as propylamine, dimethylamine, diethylamine, ethanolamine, pyrrolidine, piperidine, morpholine and piperazine have bad odor and strong toxic characteristics. Some amines were reported as precursors of carcinogenic *N-nitroso* compounds.

In previous study, we have surface modified the rayon based-ACF by acids such as HNO_3, H_2SO_4, H_3PO_4, and examined propylamine adsorption to select the most promisable chemicals. Nitric acid was recommended as one of good chemicals for the modification of ACF surface ACF samples.

In this study, effect of functional groups of ACFs on propylamine adsorption was investigated by changing the modification variables with nitric acid.

Specific surface area and total pore volume of ACF modified by 1M nitric acid were reduced to 1308 m^2/g and 0.527 cm^3/g, respectively. But, average pore volume increased from 15.6Å to 16.1Å. Surface functional groups increased, especially carboxylic and phenolic groups increased dramatically.

Oxygen and nitrogen content increased by nitric acid modification from 4.3 to 10.6 and 0.4 to 1.4%, respectively. Nitrogen content increased twice during the propylamine adsorption, while oxygen content was reduced in comparison with as-received ACF. This is due to nitrogen in propylamine molecule. Oxygen and nitrogen atomic ratio were reduced as the increase of temperature. However, small amount of oxygen and nitrogen were still remained on the surface of ACF after heating at 900℃.

In XPS spectrums, two peaks of pyridine-like structure (BE=398.6±0.2eV) and pyrrolic structure or amine moieties(BE=400.2±2eV) were mainly increased. It is believed that the first peak is pyridine-like structure by combination $-NH_2$ with propylamine and neighborhood two carbons on the surface of ACF. Increase of second peak is also due to the pyrrolic structure composed with $-NH_2$ of propylamine and surface carbons of ACF or propylamine residues adsorbed on ACF.