THE ADSORPTION-DESORPTION BEHAVIOR OF PITCH-BASED HIGH SPECIFIC SURFACE AREA ACTIVATED CARBONS

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Introduction

It had been reported that activated cokes with high surface areas could be obtained by a directly chemical activation using potassium hydroxide(KOH) and had been used in some fields such as methane storage, municipal water treatment, catalysts and catalysts supports, etc.(1-4).

In this study, oxidative stabilized pitch derived from ethylene tar oil was chosen as starting raw material to prepare activated carbon with high specific surface area(PHAC) by using potassium hydroxide as activation agent(2). The adsorption-desorption properties of PHAC were also studied .

Experimental

Preparation of PHAC and PACF

PHAC was prepared through the following processings: started by pulverizing pitch (softening point: 250 ℃); subsequently by oxidizing to stabilized pitch under heat air flow from room temperature to 320 ℃ at the heating rate of 2 ℃ /min ; and finally followed by KOH activating to PHAC at 900 ℃ for 60min under nitrogen atmosphere at the heating rate of 10℃/min after mixing of a part pitch and four parts KOH(wt/wt). A pitch based activated cabon fiber (PACF) and a commercial granular activated carbon were chosed for comparision. The BET surface areas and Iodine adsorption capacities of PHAC, PACF and AC were summerized in Table 1.

Adsorption-desorption of PHAC

Adsorption-desorption properties of PHAC, PACF and AC were measured through weight gain using Thermal Analyzer(Dupont Instruments Series 99). 50mg sample was placed in a thermogravimetric balance, dried at 150℃ in helium flow, and followed by the adsorption of saturated benzene vapour (helium as carrier gas, the total flow rate was 20ml/min) at 25 ℃ . The desorption of PHAC after benzene adsorption was carried out under 150 ℃ by under helium flow with a heating rate of 37ml/min. Such process was repeated again to investigate its regeneration ability.

Results and Discussion

Adsorption-desorption poperties of PHAC

Figure 1 describes the benzene adsorption-desorption behaviours on PHAC, PACF and AC Compared with PACF and AC , PHAC has a surprising adsorptive capacity to benzene. In the first run of the adsorption and desorption process, the maximum adsorptive capacity of PHAC to benzene is 970mg/g , but those of PACF and AC are 600mg/g and 375mg/g, respectively. The slope of adsorptive branch of PHAC is steeper than those of PACF and AC, which means PHAC has the quickest adsorptive velocity. It should be noted that the adsorptive branch of PHAC consists of two stages, illustrated a straight line and a curved line (parabola), and the former is similar to the adsorptive branch of PACF, but the latter is different, implying that PHAC still contains a few micropores and supermicropores, in which the diffusion of benzene molecular is relatively difficult, reducing the relocity, even though PHAC has faster desorptive velocity than PACF and AC.

In the second cycle of the adsorption and desorption (seen in Figure1-b), the branches of the adsorption and desorption of PHAC are similar to those in Figure 1-a,

but the mamixum adsorption capcaity of PHAC to benzene decreases to 910mg./g by only 6%. In the meanwhile, that of AC decreases by 12%. These indicated that PHAC has less irreversible adsorption than AC and a good regeneration charateristics.

References

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Table 1 Basic properties of the samples

Sample		PHAC	PACF	AC
BET surface area	(m^2/g)	2666	2200	1100
Adsorption capacity to Iodine(mg/g)		2630	2014	1205

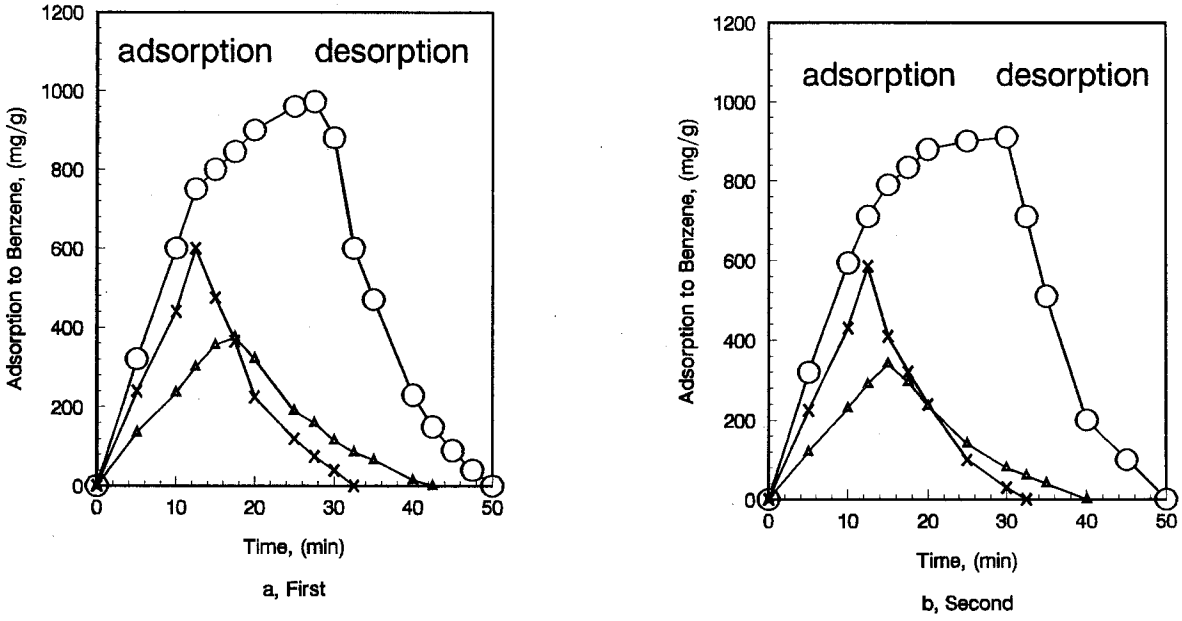

Figure1, Adsorption-desorption behaviour of the samples to benzene vapour