

POSTER

The Ability of Pitch Based Activated Carbon Fiber to Remove SO₂

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Introduction

The present authors have reported that PAN-ACF heat-treated at 800°C can adsorb, oxidize and hydrate SO₂ into aq.H₂SO₄ which can be recovered continuously in conc. H₂SO₄ by additional amount of H₂O onto the ACF. This allow complete SO₂ removal in the flue gas. Higher activity of ACF with less amount of H₂O is wanted to reduce the volume of facility. The objective of the present report is to study SO₂ removal ability of pitch-based activated carbon fiber. The heat-treatment of the pitch ACFs up to 1000°C was found very effective in enhancing the removal ability.

Experimental Section

OG series of pitch based ACFs were supplied by Osaka gas Co.. They were heat-treated in nitrogen gas at several temperatures. Some of their properties are summarized in Table 1. SO₂ removal was carried out at 30°C, using a fixed bed flow reactor. Weights of ACF were 0.25 or 0.5g. The total flow rate was 100ml min⁻¹. The model flue gas containing SO₂ of 1000 ppm, O₂ of 5vol% and H₂O of 10vol% in nitrogen was used. aq.H₂SO₄ was recovered at the outlet of the reactor. SO₂ concentrations in the inlet and the outlet gases were observed continuously by a flame photometric detector (FPD).

Results

Figure 1 illustrates the break-through profiles of 1000ppm SO₂ at 30°C with 10% of H₂O over pitch ACFs of the as-received form by W/F of 2.5x10⁻³ g min ml⁻¹. The ACFs of the as-received form removed 20-30% of SO₂, while larger surface area samples appeared to remove slightly more SO₂.

Figure 2 illustrates favorable influences of heat treatment on the activity of OG-20A. Stationary removal of SO₂ was enhanced very much by the heat-treatment above 800°C. The activity was enhanced at higher temperature up

to 1100°C. Complete removal was achieved for at least 15h with ACFs heat-treated above 800°C. The ACF heat-treated at 1100°C removed completely SO₂ at W/F of 1x10⁻³ g min ml⁻¹. The Activity enhancement is remarkable.

Figure 3 summarizes activities of ACFs which have different specific surface area for SO₂ removal at 30°C by W/F of 2.5x10⁻³ g min ml⁻¹. These ACFs were calcined at 900°C in nitrogen gas. The heat treatment at 900°C increased significantly the activity of all ACFs, providing the stationary removal of SO₂ at 100% over OG-20A, 80% over OG-10A, 8A and 7A, and 60% over OG-5A. Such activity appears to correlate to the surface area of as-received forms. Although the heat treatment reduced the surface area to a considerable extent.

References

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Table 1 Some properties of active carbon fiber

ACFs	Ultimate analysis (wt%)					Surface area (m ² /g)
	C	H	N	O	Ash	
FE-300	78.1	1.4	4.5	16.0	0.3	850
FE-300-800 ^{a)}	88.2	0.8	3.6	4.1	3.3	840
OG-5A	89.6	1.1	0.7	8.2	0.3	480
OG-5A-900 ^{a)}	92.3	0.9	0.7	5.6	0.5	560
OG-7A	90.8	1.0	0.6	7.4	0.2	690
OG-7A-900 ^{a)}	93.5	0.7	0.5	4.9	0.4	610
OG-8A	91.2	0.9	0.6	7.0	0.3	840
OG-8A-900 ^{a)}	94.0	0.6	0.3	4.7	0.4	700
OG-10A	91.6	0.9	0.5	6.7	0.3	1060
OG-10A-900 ^{a)}	94.0	0.8	0.4	4.4	0.4	820
OG-20A	93.9	0.9	0.3	4.6	0.5	1550
OG-20A-900 ^{a)}	95.8	0.6	0.3	2.8	0.5	1320

a) Calcination temperature (°C)
 FE-series : PAN based active carbon fiber
 OG-series : Pitch based active carbon fiber

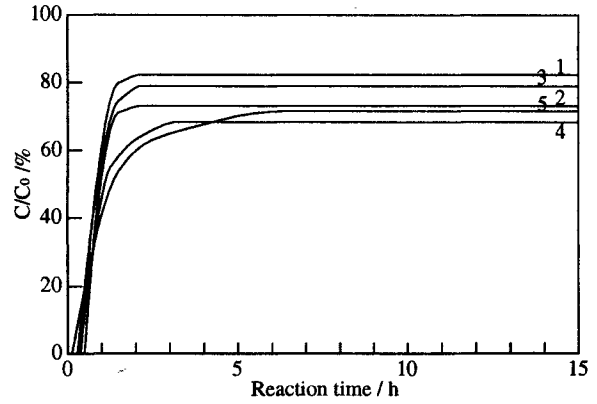


Fig. 1 Breakthrough Profiles of SO₂ over Pitch-ACFs
 SO₂ 1000ppm, O₂ 5 vol%, H₂O 10 vol%
 W/F = 2.5 × 10⁻³ g min mL⁻¹ Reaction Temp. 30 °C
 1: OG-5A
 2: OG-7A
 3: OG-8A
 4: OG-10A
 5: OG-20A

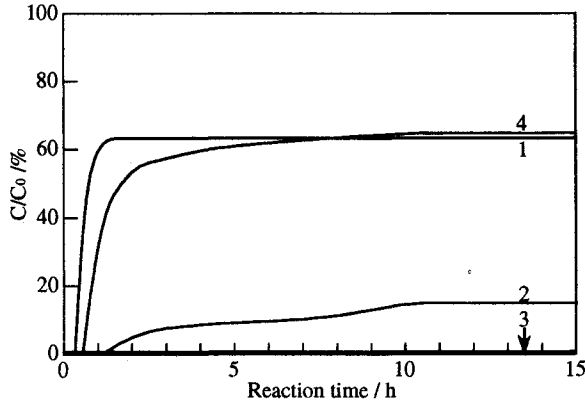


Fig. 2 Breakthrough Profiles of SO₂ over Pitch-ACFs at 30 °C
 SO₂ 1000ppm, O₂ 5 vol%, H₂O 10 vol%
 W/F : 1.0 × 10⁻³ g min mL⁻¹
 1: OG-20A-H900
 2: OG-20A-H1000
 3: OG-20A-H1100
 4: OG-20A-H1200

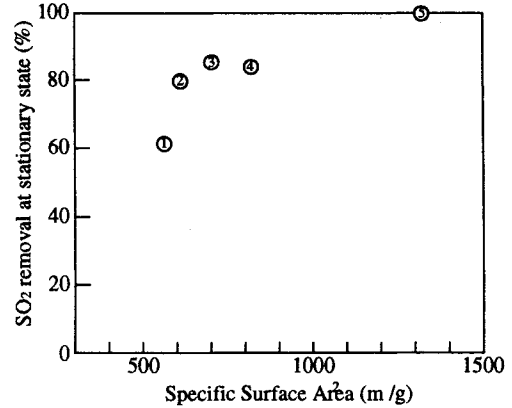


Fig. 3 The effects of Specific Surface Area for SO₂ removal of Pitch-ACFs
 SO₂ : 1000ppm, O₂ : 5 vol%, H₂O : 10 vol%
 W/F = 2.5 × 10⁻³ g · min · mL⁻¹
 Reaction Temp. = 30 °C
 Calcination Temp. = 900 °C
 1:OG-5A-H900
 2:OG-7A-H900
 3:OG-8A-H900
 4:OG-10A-H900
 5:OG-20A-H900