# ADSORPTIVE REMOVAL OF DIMETHYL SULFIDE (DMS) IN CITY GAS WITH ACTIVATED CARBONS AND CARBON FIBERS

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## Introduction

Natural gas is expected a clean fuel of minimam emmisiion of CO2,NO2,or SO2 per unit energy comsumption. Hence it is most promising fuel for fuel cell. Nevertheless sulfur compounds such as tert-butyl sulfide (TBS)and dimetyl sulfide(DMS) added for the safety owing to their strong smell, poison the catalyst metal on electrode for reforming CH4 into H2 and CO metal on electrods. Then removal before the reforming is now very essential. There are reported several metals to trap sulfur. Nickel, zinc and manganese on zeolite and active carbon are known as sulfur trap.

In the present study, active carbons and active carbon fivers were examined as adsorbents to remove DMS in the city gas. We are interested in what characteristics of the absorbents are influenced on the extent of removal and capacity.

# **Experimental**

The active carbons and active carbon fibers examined on the examined study are listed in Table 1. The surface areas distributed from 450 to 3100 /g. The pore sizes were meso (MP60, 90 and MGC) and micro (other adsorbents), Oxygen content distributed from 5% to 13%. Adsorption capacity was measured

by a flow system (Figure 1). City gas supplied by Tokyo Gas was flown at 30 through the adsorbent bed (200mg) in the reactor by the flow rate was of 100 ml/min

## Results

Figure 2 illustrates breakthrough profiles of DMS over as-received ACFs. DMS was trapped completely for a few hours and then rapidly broke through except for MP-60. The time of breakthrough was very dependent upon the ACFs. The breakthrough time was longer in the order of FE-100 MP-60 OG-20A OG-5A MP-90.

Figure 3 illustrates breakthrough profiles of DMS over ACs.Maxsorb showed the largest capacity, it's breakthrough time being as long as 10h. MGC showed 3h of breakthrough time.

Figure 4~6 illustrate pore size distribution of as-received FE-100, OG-5A and MP-90 by BET. Tha radius at the former two was less than 10 . In contast, MP-90 carried pore longer than 10 .

## Discussion

Active carbon and active carbon fibers trap DMS for a certain time. The capacity mesured as breakthrough time depends

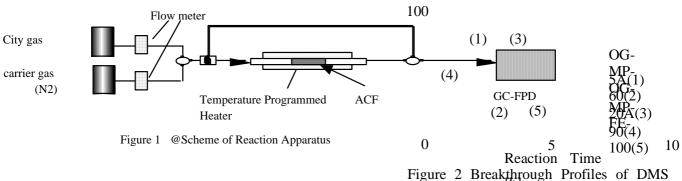


Figure 2 Breakthrough Profiles of DMS over ACFs

storongly on the k¥ind of AC and ACF. Surface area, oxygen and nitrogen functional groups pore sizeand capacity. MGC and FE-100 showed the next largest capacity. Their surface areas are moderate however then oxygen and nitrogen contents are fairly high. Pore size may be also influencial. Mesoporous MGC and MP60 showed gradual increase of sulfur concentration after the breakthrough.

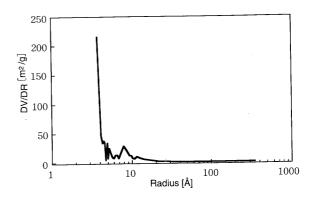


Figure 4 pore size distribution of as-received FE-100

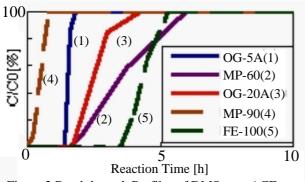


Figure 2 Breakthrough Profiles of DMS over ACFs

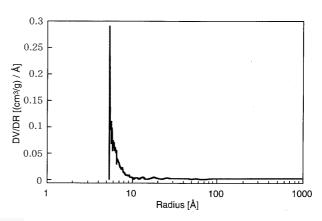


Figure 5 pore size distribution of as-received OG-5

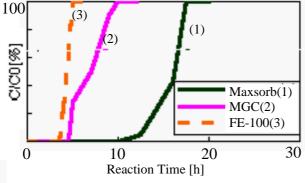


Figure 3 Breakthrough Profiles of DMS over Pitch-ACFs and AC

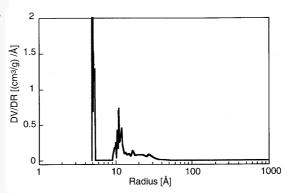


Figure 6 pore size distribution of as-received MP-90

Table 1 Some properties of as-received Pitch, PAN-ACFs and AC

	surface area [†F/g]	Elemental analysis [wt %]			
		С	Н	N	O(diff:)
(Pitch-ACF)					
FE-100	450	77.5	1.8	9.7	11.0
(PAN-ACF) OG-5A OG-20A MP-60 MP-90 (AC)	572 1930 1270 1370	89.5 95.7 90.5 90.4	1.1 0.8 1.2 0.9	0.7 0.3 0.3 0.2	8.7 4.8 8.0 8.5
Maxsorb MGC	3100 701	86.0 80.6	0.7 1.9	0.3 3.6	13.0 8.2