ENCLOSURE (B) 4

EFFECT OF VISCOSITY OF PASTE OIL ON COAL HYDROGENATION

by

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LIST OF TABLES AND ILLUSTRATIONS

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SUMMARY

Autoclave studies were made to determine the effect of the viscosity of paste oil on the hydrogenation of Fushun coal.

The results of these experiments indicated that variation in viscosity of the paste oil had no appreciable effect on the hydrogenation.

I. DETAILED DESCRIPTION

Experiments were conducted in an autoclave. A detailed description of the test procedures is given in report No.3 of "Studies on the Hydrogenation of Coal". Fushun coal, sieved to 60 mesh or below, was used. The paste oils were obtained from the low-temperature carbonization of Shinbara coal in a Davidson type retort.

Two runs were made, one using total tar and one using heavy tar made by topping 30% of the light oil from the total tar.

Properties of these oil are given in Table I(B)4.

The autoclave charge was composed as follows:

Coal	100/grams	
Tar	50/grams	
Fe_2O_3	5/grams	(commercial grade)
Hydrogen	19/grams	(100 atm. at S.C) (99.5% purity)

Experimental results are summarized in Table II(B)4 and Table III(B)4.

II. CONCLUSIONS

It is concluded from these tests that the variations in boiling range, viscosity, etc., of the two paste oil fractions, had no significant effect on the yield or quality of the products from hydrogenation of Fushun coal.

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Table I(B)4
PROPERTIES OF PASTE OILS

	Crude Tar	Heavy Tar
Specific Gravity (20°C)	0.99	1.02
Flash Point (°C)	63	121
Viscosity Rd. No.1 at 30°C (sec)	93	1180
Viscosity at 40°C (sec)	64	358
Acidity (Vol.%)	38	36
Industrial Analyses (wt.%)		
Water	1.5	-
Dirt	0.5	0.5
Light Oil (230°C)	27	6
Heavy Oil (230-360°C)	49	61
Pitch	22	32
Ultimate Analyses (wt.%)		
Carbon	83.9	85.4
Hydrogen	9.3	9.5
Oxygen	6.0	4.2
Nitrogen	0.6	0.7
Sulphur	0.2	0.2
Cal. Value	9.700	9.760

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Table II(B)4
TEST CONDITIONS AND PRODUCTS

	Run Number			
	5		9	
Reaction Condition				
Paste Oil	Crude Tar		Heavy Tar	
React. Temp. (°C)	480		480	
Initial Pressure (atm)	102		97	
Pressure Drop (atm)	19		10	
React. Time (hr-min)	1-0		1-0	
Yield of Products				
Gas	39.6		46.1	
Water	12.1		10.0	
Oil	83.3		79.5	
Residue	24.8		28.6	
Total	159.8		164.2	
Gas Analyses	Vol.%	(gm)	Vol.%	(gm)
CO_2	0.2	0.8	1.2	5.5
C_nH_{2n}	0	0	0.6	1.6
O_2	1.0	-	0.6	-
CO	2.0	4.8	1.4	4.5
H_2	86.5	14.6	84.0	16.5
C_nH_{2n+2}	7.7	19.4	8.3	18.0
N_2	2.6	-	3.9	-
Carbon Number of S.H.C.	2.0	-	1.4	-

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Table III(B)4
YIELD AND PROPERTIES OF OIL PRODUCED

		Run Number 5			Run Number 9		
Yield of Produced Oil (gm)							
Crude Oil "A"		94.0			57.0		
Crude Oil "B"		26.2			61.1		
Total Oil		120.2			118.1		
Yield of Water from Crude Oil "A" (gm)		12.1			10.0		
Properties of Produced Oil		Yield(gm)	d_{20}^{20}	(vol.%) Tar acid	Yield	d_{20}^{20}	(vol.%) Tar acid
	-180°C	14.4	0.844	13.0	6.7	0.744	8.0
	180-230°C	8.5	0.942	35.0	6.5	0.928	31.0
	230-280°C	16.1	0.950	-	14.3	0.963	32.0
	280-360°C	18.6	0.977	26.0	22.4	1.044	16.0
	Pitch	25.0	1.160	-	27.7	1.117	-
	Total	82.6	-	-	77.6	-	-
Yield of Residue (gm)							
Soluble in Benzene		0.7			1.9		
Organic Residue		13.6			18.2		
Ash		11.2			10.4		
Total		25.5			30.5		