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Aromatization of Bituminous Coal Liquefaction Middle Oil, Its Acid Constituents and the Residual Oil over Alumina-Terrana Catalyst, Type 8688.

By Trofimow, Ludwigshafen, 4 March 1943

Bituminous coal liquefaction middle oil from Scholven (P 1271), 180-325°C, was decomposed into acid constituents (phenols) and residual oil by 2nNaOH. The following results were obtained in aromatization of the separate constituents at 250 atm:

Catalyst	7019		Type 8688			
	P 1271		P 1271		Phenols from P 1271	
Product	With Phenols	Residual Oil	With Phenols	Residual Oil	Space-Time-Thruput 1.0	0.6
165°C Gasoline Concentration	30	23	31	22	64	74
Space-Time-Yield	0.26	0.21	0.27	0.20	0.54	0.38
% Gasification of Gasol. + Gasif.	26	36	26	37	16.5	10.6
C_4 in Gasif.	29	31	23	25	33	27
i-C_4 in total C_4	24	13	22	14	10	41 - ?
Spec. Grav.	0.797	0.774	0.785	0.780	0.792	0.793
A.P. I/II	1/48	9/49	2/48	5/50	6/43	9/43
% - 100° C	32	36	42	41	43	39
%/Wt. Aromatics	53	42	47	46	39	37
Oct. No. - M.M.	78.5	75.5	77	77.5	77	77
+0.12% Pb	89.5	90.0	90	90	90	90
Residual Gasol.						
% - 100° C	41.5	55	50	-		60
Oct.No. - M.M.	66	65	70	-		73

Just as with catalyst 7019, there is a distinct difference between the processing of dephenolized bituminous coal liquefaction middle oil and that containing phenols with alumina catalyst 8688. Experimental data show that, in aromatization with alumina-terrana catalyst, removing the phenols also greatly influences the results.

The 160° C gasoline yield has dropped 25%, from 0.27 to 0.20. At the same time, gasification rose from 26 to 37%. However, the composition of gasification shows no appreciable differences, apart from the somewhat low isobutane content. Contrary to catalyst 7019, the gasolines of both operating periods have the same composition, boiling behavior and anti-knock properties.

In another series of experiments the phenols from P 1271 were aromatized with thruputs of 1.0 and 0.6. With a thruput of 1.0, 64% gasoline to 165° C was formed, and 74% with a thruput of 0.6. Gasification, based on gasoline plus gasification, herewith was 16.5 and 10.6%, respectively. The gasolines show the same boiling behavior as the aromatization gasoline from P 1271. The gasoline consists of 6% paraffins, 54% naphthenes and 40% aromatics. It is, therefore, very rich in naphthenes. The residual gasoline therefrom is composed of 90% naphthenes and 10% paraffins, and with 60% constituents boiling to 100° C has an octane number, by the motor method, of 73, or 88.5 with 0.12% Pb.

The middle oil had an aniline point lower by 10° C than the P 1271 aromatization B-middle oil. It still contained 8-10% phenols.

After running phenols, the catalyst had lost about 25% of its splitting activity.

Just as experiment 7019, this experiment also shows that phenols have an important part in the formation of gasoline. But the phenols participate much less than with 7019 in the formation of aromatics.

TABLE I

Injection Product	P 1271 6.10.41	P 1271 dephenol 7.1.41	P 1271 16.9.42	P 1271 dephenol 9.1.42	Phenols from P 1271	
Spec. Grav.	0.968	0.954	0.970	0.960		
Aniline Point	-18	-15	-19	-22		
Boiling Limits						
Phenol Content						
Catalyst	7019		Type 8688			
Press. atm	250		250		250	
Temp. mV	26.5		26.0		26.0	
Thruput, kg/L/h	1.0		1.0		1.0	0.6
Gas:Oil	2.0		2.0			2.0
Recycle	1:1	no	1:1	no		no
Spec. Grav.	0.860	0.870	0.870	0.880	0.834	0.825
Gasol. Concentr.	30	23	31	22	64	74
Yield, Kg/L/h	0.26	0.21	0.27	0.20	0.54	0.38
% Gasif./Gasol.+Gasif.	26.2	36.0	26.0	37.0	16.5	10.6
%/Wt. C_4 in Gas	29	31	23	15	33	27
% i-C_4 in total C_4	24	13	22	14	10	41 - ?
Gasol: Spec. Grav.	0.797	0.774	0.785	0.780	0.792	0.793
A.P. I/II	1/48	9/49	2/48	5/50	6/43	9/43
Initial Boil	39	34	42	45	62	60
% - 70° C	6	11	7	5	1	1
% - 100	32	36	42	41	43	39
% - 150	92	91	91	92	94	94
% - 160	97	94	96	96	-	-
End Point	167	170	160	165	163	160
Composition:						
Paraffins	12	18	15	18	6	6
Naphthenes	33	38	37	35	53	57
Aromatics	53	42	47	46	39	37
Unsaturated	2	2	1	1	2	-
Oct. No. - M.M.	78.5	75.5	77	77.5	77	77
+0.12% Pb	89.5	90.0	90	90	90	90
Mi-Oil: Spec. Grav.	0.890	0.908	0.910	0.924	0.916	0.929
A.P.	-11	-8	-14	-20	-26	-26
End Point	298	308	310	315	275	320

Phenols 10%
Resid. Gasol. - 165°C
%-100 : 60
Paraffins: 10
Naphthenes: 90
Oct.No.-M.M.:73.0
+0.12%Pb:88.5

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