ENCLOSURE (B) 4

STUDIES ON THE APPLICATION OF FISCHER OIL

by

NAV. CHEM. ENG.
DR. T. ITAKURA

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LIST OF TABLES AND ILLUSTRATIONS

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SUMMARY

It is well known that Fischer condensate oil has a high cetane rating and also a high pour-point. To use this stock as a diesel fuel it is necessary to lower the pour point, and for this purpose treatment with mildly oxidizing catalysts was considered most promising. In preliminary tests it was found that treatment over CrO_3 supported on acid clay lowered the pour point of Fischer oil about 15°C. The investigation was stopped due to economic unattractiveness of the process.

I. INTRODUCTION

The 200-300°C. fraction of Fischer condensate oil has a high cetane value (about 80) owing to the fact that it is composed mainly of normal hydrocarbons C_{13}-C_{17}. This fraction, however, has a pour-point of 8-10°C., and it is necessary to reduce same to below -5°C, in order to produce a satisfactory diesel fuel. This work was undertaken to investigate the lowering of pour point by the catalytic action of mild oxidizing agents. It was carried out during April-May, 1944 by Nav. Eng. Lieut. H. TAKEMURA and G. NISHIMURA. This work was stopped because the process appeared economically unattractive due to the low space velocity required.

II. DETAILED DESCRIPTION

A diagram of experimental apparatus employed is shown in Figure 1(B)4.

A catalyst boat was inserted in the middle of the pyrex glass reaction tube (3 x 100cm), which was electrically heated to maintain the required temperature. The raw oil was dropped into the upper part of the reaction vessel and vaporized. The vapor passed over the catalyst and was partially converted into cyclic hydrocarbons.

The product was then condensed and collected in the receiver.

III. EXPERIMENTAL RESULTS

The extent of conversion of condensate oil into naphthenic or aromatic hydrocarbons was not determined. The pour point of the product, however, was lowered about 15°C, through treatment over CrO_3 catalyst. This was due to the fact that a part of the raw oil was changed into cyclic hydrocarbons. Accordingly, the cetane rating of the product dropped about 4.5 units. In so far as the activity of catalyst is concerned a mixture of one part of CrO_3 and nine parts (by weight) of acid clay was the most effective of the three catalysts tried under the reaction conditions (temp. 250-300°C, gaseous space velocity about 350, and atmospheric pressure). When ZnO was used instead of CrO_3, the activity was inferior. The activity of CuO catalyst was slightly below that of ZnO catalyst. All catalysts tested were composed of one part of the oxide plus 9 parts (by weight) of Japanese acid clay. The materials were mixed together in form of a water slurry and were oven-dried. The yield of product was about 99% with the use of CrO_3 catalyst, the loss being mainly gas.

IV. CONCLUSIONS

By treatment over CrO_3 catalyst, the pour point of Fischer condensate oil was lowered 15°C, and its cetane number dropped 4.5 units.

The activity of the three catalysts employed was as follows:

$$CrO_3 > ZnO > CuO$$

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Table I(B)4
RESULTS OF TREATMENT OVER CrO_3 CATALYST

	Fischer condensate	Treated oil
Sp. gr. (15/4°C)	0.7832	0.7940
Viscosity (R-1,30°C)(sec)	34.4	31.6
Pour pt., °C.	9.0	-7
Ash, wt. %	trace	0.02
Conradson carbon	trace	trace
Impurities	trace	trace
Cetane number	81	76.5

Distillation (°C)

F.D.	172
10%	192
50%	224
90%	296
95%	320
D.P.	331

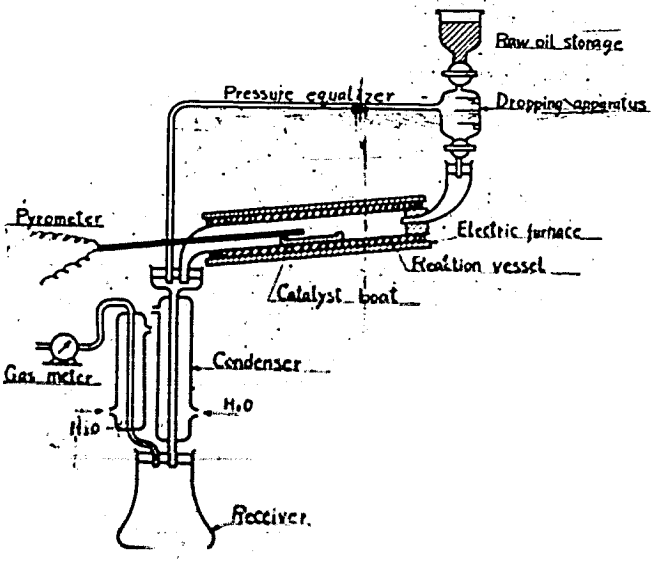

Figure I (B)4
DIAGRAM OF EXPERIMENTAL APPARATUS