ENCLOSURE (B) 11

UTILITY TESTS OF PINE ROOT OIL

by

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LIST OF TABLES AND ILLUSTRATIONS

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SUMMARY

Aviation gasoline prepared from pine root oil by catalytic cracking or hydrocracking in the First Naval Fuel Depot showed no difference from gasoline No. 1 (see following page) in connection with engine performances, and starting and acceleration abilities. Although the gasoline produced by catalytic cracking was said to cause gum-swelling in the fuel line of engines, no trouble was actually encountered during the flight test period. Crude pine root oil with 50% of (by vol.) 99% alcohol caused a large amount of deposit in the fuel line, for instance, in the carburetor nozzle, acceleration pump, fuel pump, and filters. Moreover, its practical antiknock ability was under 87 octane gasoline and it was impossible to apply this gasoline to practical engines before the end of the war.

I. INTRODUCTION

A. History of Project

In March 1945, the treatment of pine root oil was completed in the First Naval Fuel Depot, and two kinds of samples were sent to the First Naval Technical Depot to examine their applicability by bench and flight tests in practical engines. Results were obtained in April 1945. In May 1945, a sample of crude pine root oil with 50% of 99% alcohol was sent to the First Naval Technical Depot, and immediate investigations were made applying the bench tests of practical engines.

B. Key Research Personnel Working on Project

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II. DETAILED DESCRIPTION

A. Description of Test Apparatus

Engines: HOMARE 20 type
Aeroplane: SHIDEN (fighter with HOMARE 20 type engine)

B. Test Procedures and Experimental Results

The two kinds of aviation gasoline produced from pine root oil by the First Naval Fuel Depot by catalytic cracking or hydrocracking had almost the same properties as the No. 1 gasoline. HOMARE 20 type engine was operated with these fuels on a performance test bench utilizing a Froude dynamometer. Maximum allowable boost pressures and minimum economical consumptions were examined and the following data obtained (from memory):

Maximum allowable boost pressures of the two samples showed the same results as the gasoline No. 1. Although minimum economical consumptions in grams/hp-hour of the sample by catalytic cracking showed somewhat greater results than gasoline No. 1 specific gravity of the former was somewhat heavier than that of the latter, thus actually giving the same consumptions in lit/hp-hour. These performances were ascertained by flight tests of the SHIDEN airplane. Although it was considered that the sample from catalytic cracking would give gum-swelling trouble in the fuel line (BUNA-N) of engines, because of the large percentage of aromatic compounds, no actual trouble was encountered during the bench and flight test period.

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There was no trouble with starting and accelerating abilities of the engines. Also no gum troubles were encountered in practical service.

Crude pine root oil with 50% of 99% alcohol caused engine trouble due to the large amount of deposits in the fuel line; i.e. the carburetor nozzle, acceleration pump, fuel pump, and filters. Moreover, its practical anti-knock ability was lower than that of 87 octane gasoline, rendering its use for practical combat aeroplanes unsuitable.

III. CONCLUSIONS

The two samples of gasoline prepared from pine root oil (one by catalytic cracking and the other by hydrocracking) were found suitable as substitutes for gasoline No. 1.

Table I(B)11
PROPERTIES OF AVIATION GASOLINES FROM PINE ROOT OIL

	Sample from Catalytic Cracking	Sample from Hydrocracking	No. 1 Gasoline
First Drop	45.5°C	48°C	60°C max
10% pt	76	85	90 max
50	115	110	115 max
90	149	155	160 max
97	167	170	170 max
Sum of 10,50,90%	over 260°C	over 260°C	260°C min
Leaded	0.15%	0.13%	0.15% max
Vapour Pressure	0.6 kg/cm^2	0.4 kg/cm^2	under 0.6 kg/cm^2
Specific Gravity	0.78	0.74	0.73 - 0.74

Table II(B)11
PERFORMANCE TEST OF AVIATION GASOLINES FROM PINE ROOT OIL

	Sample from Catalytic Cracking	Sample from Hydrocracking	No. 1 Gasoline
Allowable Max	(1st speed) +500mm/Hg	(1st speed) +500mm/Hg	(1st speed) +500mm/Hg
Boost Pressure	(2nd speed) +350mm/Hg	(2nd speed) +350mm/Hg	(2nd speed) +350mm/Hg
at 3000 RPM	over 125mm/Hg with supplementary fuel		
Min Economical Consumptions at 2000 RPM -200mm/Hg	220 gm/hp-hour	210	210