PROGRESS REPORT

(November, 1977)

Report No.: C00-2982-21

Project: Conversion of Cellulosic and Waste Polymer Material to Gasoline

Contract No.: EY-76-S-02-2982.*000

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The emphasis continues to be on improvement of pyrolysis gas composition to enable higher yields from the Fischer-Tropsch catalytic reactor. The premise is that the pyrolysis gas composition will be acceptable if the residual inerts are bled from the system. The goal is to achieve this with stable, uninterrupted pyrolysis reactor performance. The best pyrolysis gas composition achieved during the month is as follows (mole %):

H ₂	10.5
CO	41.9
CO ₂	17.9
CH ₄	10.3
C ₂ H ₄	5.1
C ₂ H ₆	1.8
O ₂	0
N ₂	12.5
	<hr/> 100.0

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Some operational difficulties were encountered during the month (scrubber drain plug, sand blowover, pressure tap plug, melted downcomer tube). Product composition from the Fischer-Tropsch system using real pyrolysis gas remains satisfactory.

A series of runs on the Fischer-Tropsch system using synthetic pyrolysis gas were conducted. The purpose was to determine the effect of pressure on

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product yields. Results are plotted in Figure 1. Clearly, the product yields increase with an increase in pressure with a possible leveling at about 100 psig.

Run No. 8 (Progress Report C00-2982-20, Table 2) was rerun on the catalytic reformer with a yield value of 83. A summary table of the relative importance of the three factors studied is as given in Table 1. Temperature remains the dominant factor. An optimization study (quadratic model fit, model optimization, experimental verification) is proceeding for this system with the following objective:

Maximize Yield

Subject to:	80	$\leq$	octane number	$\leq$	92	
	850	$\leq$	reactor temp.	$\leq$	1100	°F
	100	$\leq$	reactor press.	$\leq$	600	psig
	1.0	$\leq$	liquid feed rate	$\leq$	2.86	ml/min

In addition, an alternate catalyst will be tested starting at the best point from the previous study.

A current photograph of the experimental system is shown in Figure 2. The pyrolysis system is in the middle of the picture with the gasoline synthesis reaction systems on the right. The control shack on the left of the picture contains a gas chromatograph, controllers, recorders, oxygen analyzer, safety circuitry, and a terminal wired to a real time computer. The personnel shown are graduate students working on advanced degrees on the project.

A slide presentation and tour of the laboratory was conducted for about eighty members of the state legislature on November 12.

Figure 1. Pressure vs. Product Yield -
Fischer Tropsch Reactor

Note: See C00-2982-19, Table 1, Run 81677 for run conditions
(Some variations in feed rate to maintain proper fluidization.)

TABLE 1
REFORMER STUDY SUMMARY

<u>Factor</u>	<u>Octane Number</u>		<u>Yield</u>	
	<u>Direction¹</u>	<u>%²</u>	<u>Direction¹</u>	<u>%²</u>
temperature	+	27	-	67
pressure	+	5	-	15
flow rate	+	23	-	5
interactions		45		13

¹The sign indicates the direction of change for the response (octane number, yield) for an increase in the factor, i.e., an increase in temperature gives an increase in octane number and decrease in yield, etc.

²Percent of treatment sum of squares attributed to each factor, i.e., the larger the percentage, the more important the factor.

Figure 2. Solid Waste Conversion System