PROCESSING SUNFLOWER OIL FOR FUEL

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Systems for processing vegetable oils for use as fuel for diesel powered tractor engines could be developed close to the sites where the fuel will be used. Benefits that might result would be reduced costs of shipping and availability of fuel for farm operations at times when petroleum fuels are in short supply.

Research on processing of sunflower seed for oil was initiated at North Dakota State University to evaluate the equipment that might adapt best to on-farm or small factory production facilities. One feature identified in planning research for on-farm processing was that equipment requirements be kept to a minimum. The first devices identified for evaluation were auger press expeller units, primary oil cleaning equipment, and final filters.

Most existing oil extraction plants include screw auger type expeller units. These machines are designed with a screw auger in a perforated housing. The screw auger shaft increases in size from the inlet to the outlet until at the outlet end the shaft is the same diameter as the flighting. As seed moves through the auger, it is compressed until it is forced between this outlet shaft and the auger housing. Oil is forced out of the seed as it is compressed and flows from the machine through the perforations in the housing. Friction caused by the process provides heat for the oil so it will flow better. Seventy-five to 85 percent of the oil from sunflower seed can be extracted by this process.

Performance tests have been carried out using a CeCoCo auger press extractor unit manufactured in Japan (Fig. 1). The auger in this unit has a 2.3 inch diameter and a length of 21 inches. Tests were carried out on a second press that was developed and manufactured by Concord Inc. in Fargo, N.D. The auger in this unit has a 4 inch diameter and a length of 36 inches. A Simon-Rosedown machine from England was available at NDSU for a short time, but test results obtained are incomplete. Preliminary results of the tests for the CeCoCo and Concord machines are given in Table 1.

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Fig. 1. CeCoCo Expeller

Primary filtration is commonly used in commercial processing for the initial cleaning of the crude vegetable oil (Fig. 2). Filter aids are used to improve the performance of the filters. Preliminary testing using diatomaceous earth as a filter aid provided oil with good clarity with either settled oil or oil directly from the expeller. Cycle time was extremely short because of excessive solids. A prescreening process to remove 90 percent or more of the solids would improve efficiency. If the crude oil is permitted to settle, sediment will accumulate in the bottom of the container. Oil drawn from the upper part of the container has been filtered through finishing filters and used as fuel for short term tractor tests with no further treatment.

Filtration is necessary to prevent fouling of engine fuel systems. Filtration through a 5-micron filter has been recommended as a final process for oil for fuel. A series of standard finishing filtration tests have been run

TABLE 1. OIL EXPELLER PERFORMANCE

Expeller Description	lb seed/hr	lb oil/hr	% Extraction Efficiency
CeCoCo			
Pressure Setting 1	35	10.8	81.2
Pressure Setting 2	55	17.6	82.5
Pressure Setting 3	75	24.3	82.8
Pressure Setting 4	100	28.9	74.5
Concord			
Barrel Type 1	309	88	75
Barrel Type 2	353	88	65

on sunflower oil and sunflower oil-diesel fuel blends using sunflower oil from four commercial sources. The oils were ordered from each source using the same written description. These tests were designed to compare the filtration characteristics of the various oils and determine their suitability for use in a diesel fuel system. Further refining may be desirable to alter the oil characteristics so it will perform well in engines.

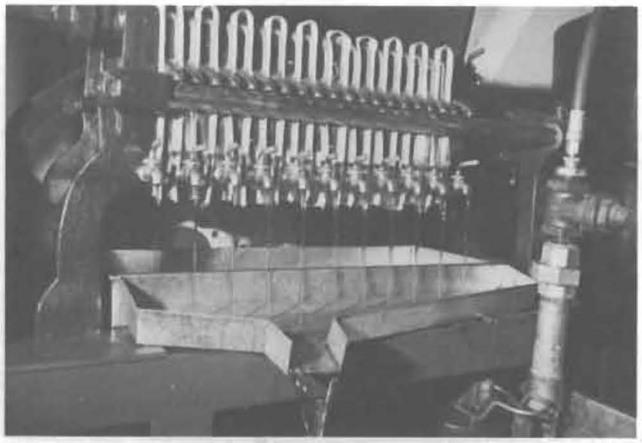

Fig. 2. Sunflower Oil Filtration

Preliminary results indicate significant differences in filtration characteristics of the oils. Figures 3-8 illustrate and compare the filtration characteristics of these sunflower oils and blends of these oils with No. 2 diesel fuel at one pressure and two temperatures. From these curves, it can be seen that sunflower oils B and C had very poor filtration characteristics at both temperatures and even blending did not substantially improve their filterability. On the other hand, the filtration characteristics of sunflower oils A and D increased substantially with an increase in temperature and an increase in percentage of diesel fuel in the blend. These curves show that not all sunflower oil, even though described in the same manner, is the same.

Plants that might serve as oil sources for fuel could include sunflower, soybean, peanut, cottonseed, rapeseed, safflower, corn, coconut, and palm. One list of 30 vegetable materials suitable for oil production has been published. Sunflower seed appears to be the oil source that best adapts to North Dakota, as well as most other parts of the U.S. For example, besides North and South Dakota and Minnesota, Texas is producing a significant amount of sunflower. It also appears to adapt to areas on both coasts. Production areas of other oil crops are more restricted.

Development of sunflower oil as a fuel would make it possible to provide energy for agriculture from sources located close to the area where it would be used. Oil from hybrid varieties of sunflower is about 40 percent of the seed including the hull. This compares to 18 percent for soybeans, 17 percent for cottonseed, 31 percent for peanuts, 36 percent for flax and safflower and 35 percent for rapeseed. As a result of the high oil content of sunflower seed, the oil yield per acre from sunflower is good. The yield of peanut seed per acre is high, but the limitation with peanut oil used for fuel is that it is grown only in the warm regions of the country and could not be locally grown in areas like North Dakota.

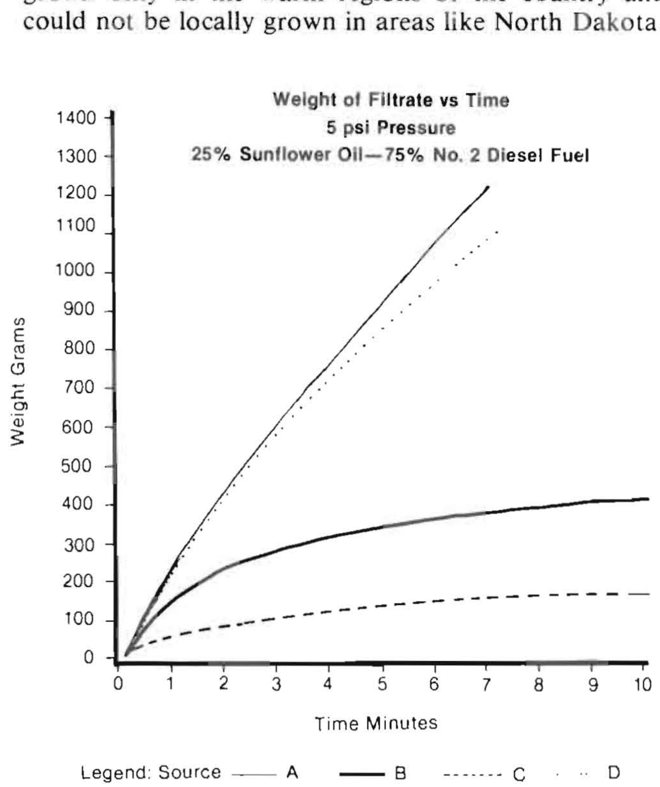

Fig. 3. FILTRATION OF SUNFLOWER OIL AT 50°F.

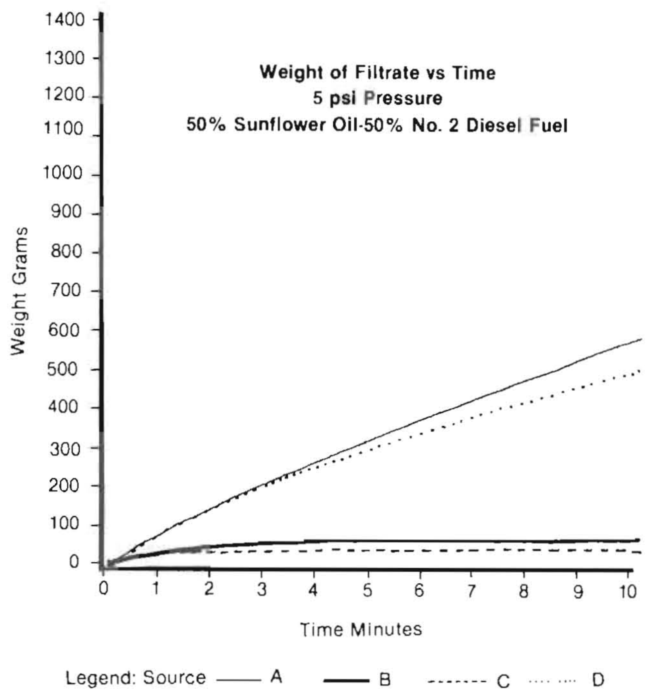

Fig. 4. FILTRATION OF SUNFLOWER OIL AT 50°F.

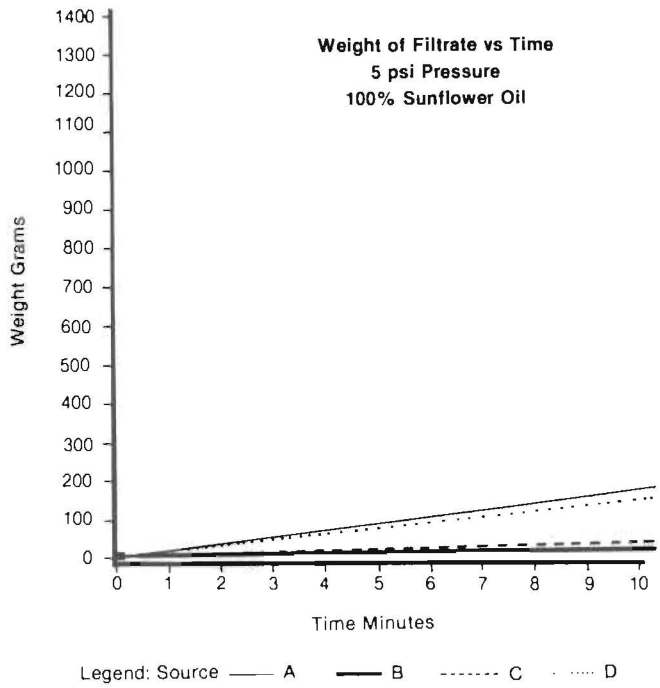

Fig. 5. FILTRATION OF SUNFLOWER OIL AT 50°F.

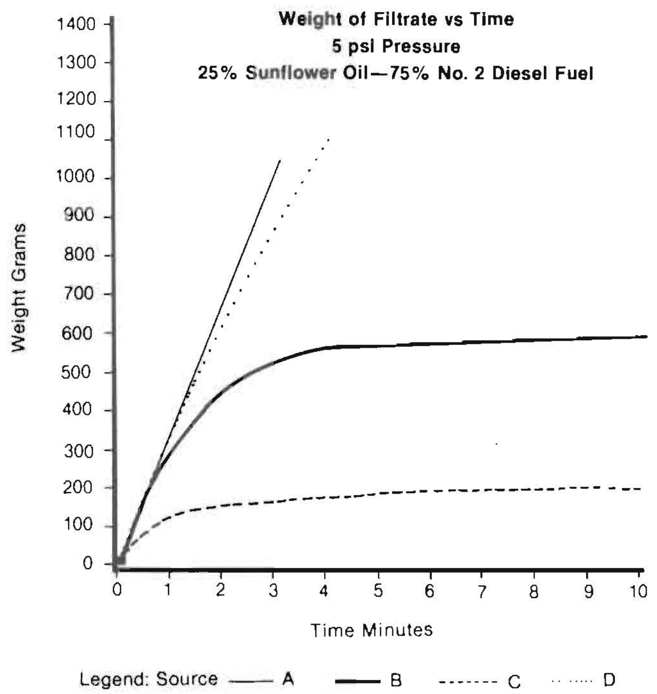

Fig. 6. FILTRATION OF SUNFLOWER OIL AT 104°F.

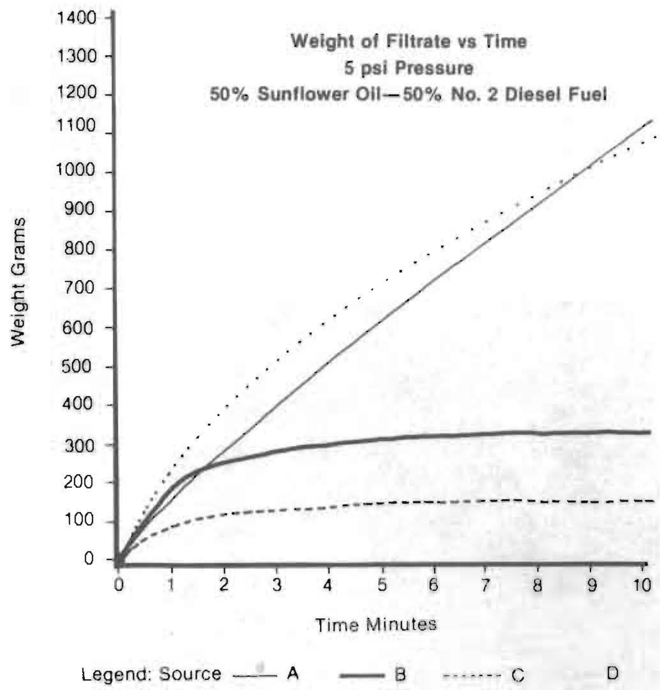

Fig. 7. FILTRATION OF SUNFLOWER OIL AT 104°F.

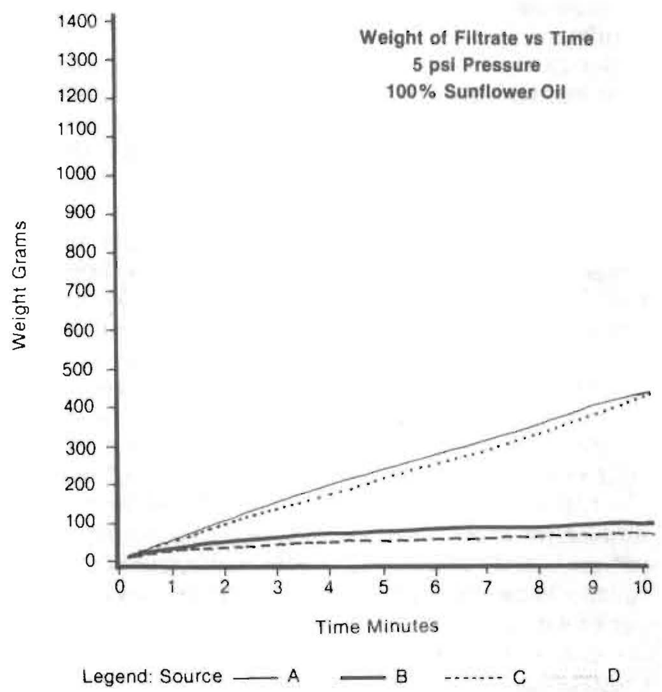

Fig. 8. FILTRATION OF SUNFLOWER OIL AT 104°F.