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EVALUATION OF FPC-1 FUEL PERFORMANCE CATALYST

ON

THE EFFECT OF FPC-1 ON USED OIL/DIESEL MIXTURE

AT

SITE NEAR PARMA, IDAHO

TEST CONDUCTED BY CFT IDAHO AND UHI CORP.

REPORT PREPARED BY
UHI CORP.
PROVO, UTAH

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The Effect of FPC-1 on Used Oil/Diesel Mixtures in Dryer Applications

1. Introduction

Many hops and mint growers in Idaho, Oregon and Washington are currently using No. 2 diesel fuel to fire their hops and mint dryers. No. 2 diesel fuel currently sells for $.80-.85 per gallon in these areas. Used, filtered motor oil is available in this same 3 state area at a price of $.30-.50 per gallon, depending upon where it is purchased, and how far it must be transported.

Consideration has been given to burning a mixture of No. 2 diesel and used motor oil in the hops and mint dryers in order to lower the overall cost of fuel. The two main concerns of the growers in burning used motor oil has been excess smoke and possible contamination of the hops and mint.

FPC-1 fuel performance catalyst is a combustion enhancer that contributes to accellerated and more complete combustion of fuel. An additional benefit of adding FPC-1 to fuel is that much less soot and smoke are formed when the fuel is burned.

On July 12-13, 1992, several interested parties met at the farm of Greg Obendorf near Parma, Idaho for the purpose of testing FPC-1 to determine if it would reduce the smoke level in various ratios of used motor oil and No.2 diesel fuel, when burned in a hops dryer. Those in attendance for the test were:

Larry Graves--CFT Idaho
Lloyd Cox--CFT Idaho
Dan Riley--CFT Idaho
Dave Stewart--UHI
Derald Downing--CMC (HVAC Contractor)
Ray Obendorf--Hops Grower
Greg Obendorf--Hops Grower
Willie Titmus--Electrical Contractor
Several Local Hops Growers

2. Test Setup

Four 55 gallon drums of fuel were prepared and taken to the test site for evaluation. The composition of the four drums of fuel was as follows:

Drum No. 1--100% No. 2 diesel fuel <u>without FPC-1 treatment.</u>
Specific Gravity = .820

Drum No. 2--50% No. 2 diesel fuel/50% used motor oil treated with FPC-1. Specific Gravity = .861

Drum No. 3--30% No. 2 diesel fuel/70% used motor oil treated with FPC-1. Specific Gravity = .870

Drum No. 4--20% No. 2 diesel fuel/80% used motor oil treated with FPC-1. Specific Gravity = .885

External sight glasses were installed in each drum in order to observe the level in each drum at any given time. With this type of arrangement it was possible to measure the rate of drop of the fuel level, and thus, the fuel consumption rate.

Discharge lines from the bottoms of the 4 drums were equipped with individual valves and manifolded so that the flow of fuel to the burner could be varied from one drum to another by simply turning two valves.

A thermocouple probe was installed at the discharge end of the firebox in order to monitor the temperature of the air as it exited the firebox. A model A7001A Honeywell Combustion Efficiency Analyzer was used to monitor temperature.

3. Test Procedure

The discharge line from drum No. 1 containing 100% diesel fuel was opened and the burner was ignited. The thermostat in the dryer room was set at 150 degrees F., and when it called for more or less heat from the burner, the temperature at the discharge end of the firebox fluctuated in the range of 1275-1350 degrees F. The rate of drop in the level of No. 2 diesel in drum No. 1 was observed and recorded over a period of time, and the fuel consumption rate was calculated. The degree of cleanliness of the exhaust gases was observed both at the discharge end of the firebox and inside of the dryer room.

The discharge line from drum No. 1 was closed and the line from drum No. 2 containing the 50%/50% treated mixture was opened. The thermostat in the dryer room was left at 150 degrees F., and, as in the case of drum No. 1, the temperature at the discharge end of the firebox remained in the range of 1275-1350 degrees F. The degree of cleanliness of the exhaust gases was again observed both at the discharge end of the firebox and inside of the dryer room.

The same procedure, as outlined above. was repeated for the 30%/70% and the 20%/80% treated mixtures contained in drum Nos. 3 and 4.

4. Test Results

Drum No. 1 100% No. 2 Diesel	Drum No. 2 50% Diesel/50% Oil	Drum No. 3 30% Diesel/70% Oil
Fuel Consumption = 27.7 gal/hr.	Fuel Consumption = 24.3 gal./hr.	Fuel Consumption = 21.6 gal./hr.
Dryer room temp. = 150 degrees F.	Dryer room temp. = 150 degrees F.	Dryer room temp. = 150 degrees F.
Visible smoke in dryer room -- NONE	Visible smoke in dryer room -- NONE	Visible smoke in dryer room -- NONE

When the 20% No. 2 diesel/80% used motor oil mixture in drum No. 4 was burned, smoke was visible both at the exit end of the firebox and in the dryer. Therefore, no fuel consumption measurements were taken for this mixture. When we reverted back to the 30%/70% mixture, there was no visible smoke.

5. Conclusions

A. By burning a mixture of 30% No. 2 diesel/70% used motor oil treated with FPC-1 fuel performance catalyst, fuel consumption in a Johnson burner used for drying hops was reduced by 22% while maintaining a constant temperature of 150 degrees F. in the dryer room. The smoke level observed when burning the 30%/70% mixture was no greater then when burning 100% No. 2 diesel.

B. If used motor oil costs $.30/gallon, and No. 2 diesel $.85/ gallon, a 30%/70% mixture would cost $.47/gallon. The cost of FPC-1 to treat 1 gallon of fuel is approximately $.03. This brings the cost of one gallon of 30%/70% treated fuel to $.50 per gallon. Because it requires 22% less of the 30%/70% treated fuel to produce the same amount of heat as 1 gallon of No. 2 diesel, the equivalent cost for 30%/70% treated fuel is $.39 as compared to $.85 for straight No. 2 diesel.

C. If used motor oil costs $.50/gallon, because of high transportation costs, and No. 2 diesel $.85/ gallon, a 30%/70% mixture would cost $.60/gallon. The cost of FPC-1 to treat 1 gallon of fuel is approximately $.03. This brings the cost of one gallon of 30%/70% treated fuel to $.63/gallon. Again, because it requires 22% less of the 30%/70% treated fuel to produce the same amount of heat as 1 gallon of No. 2 diesel, the equivalent cost for 30%/70% treated fuel is $.49 as compared to $.85 for straight No. 2 diesel.

D. Mr. Craig Flinders of UHI Corporation has investigated the potential hazards of heavy metals that are contained in used or waste motor oils. He has determined that all waste oil must be filtered to remove heavy metals and other particulates according to a specific EPA standard before it can be used as a fuel oil. The EPA standard is as follows:

Arsenic - 5 parts per million (ppm)
Cadmium - 10 ppm
Chromium - 2 ppm
Lead - 100 ppm
Halogens - 1000 ppm
Sulfur - 1.74%

Mr. Bill Bowey, Laboratory Manager for Columbia Inspection, Portland, Oregon, is an analytical chemist who specializes in waste oil analysis. Mr. Bowey reports that waste oil (or motor oil) rarely contains arsenic, cadmium or chromium, and if present, these are found in quantities of less than 1 ppm. Further, chromium in motor oil is in an inert form and would not react in the combustion process. There is no concern over hops contamination from any of these elements.

Lead is found in motor oil, but again the amount minute. Both Mr. Bowey, and Dr. Wes Parish, PhD Organic Chemist report that any lead compound produced during combustion would be very heavy and would flow downstream to the firebox floor and would not come into contact with the hops.

The hops are suspended some 15-20 feet above the ground, and perhaps 20-30 feet from the firebox. Given the distance from the firebox, it would be virtually impossible for lead compounds to reach the hops. Halogens are hydrocarbons, much like al hydrocarbon fuels (gasoline, diesel, fuel oil, etc.). Halogens must be burned in order to be disposed of. When burned, these are converted to CO_2 and H_2O, typical and harmless products of combustion. There is no hazard to the hops from the halogens.

Finally, the sulfur content of waste oil is low, and usually approximates the sulfur content of No. 2 diesel. When blended with diesel, the sulfur content can be made even lower, as are all of the above mentioned contaminants.

In summary, according to qualified chemists, the combustion of a waste oil/diesel oil blend is no more hazardous to the hops than straight diesel.