Is There a Future for Yellow Grease as a Fuel Additive?

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Editor's Note – Render is presenting the following article about a new technology/product that utilizes yellow grease to provide awareness to the industry, not as an endorsement.

Last year, yellow grease (YG) prices were at a 30-year low and exports were down. Because of this, some U.S. renderers have begun burning YG in their boilers instead of fuel oil or natural gas. It's apparent that renderers need to continually look for new and dependable YG markets.

Scientists at the CANMET Energy Technology Centre in Ontario, Canada, have proven at lab scale a process to convert YG and/or tallow to a low sulfur, high cetane premium diesel blending stock. The process used is on a refining technology called hydrotreating. Figure 1 describes the necessary equipment and the material flows. The principal output is a diesel blending stock called AGTANE (for AGricultural ceTANE) in English speaking countries (e.g., United States, United Kingdom, Australia, etc.), and BIOZOIL (for bio and Gasoil) in French speaking countries.

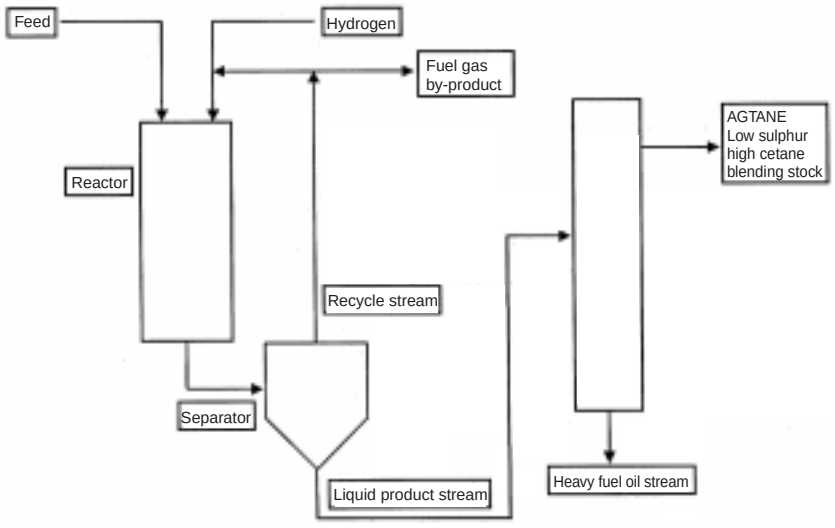
Several convergent global trends favor AGTANE production from YG. Diesel prices have risen and there is reason to expect that they will remain high. There is also increased regulatory pressure towards the increased use of diesels and biodiesels with low sulfur content and reduced particulate matter emissions. Such "clean diesels" are significantly more expensive than the diesels commonly used over the last decade.

AGTANE could provide to the rendering industry steady and continuous global outlets for sizeable YG sales (increasing and maintaining "product disappearance") while establishing a new, reliable, and deep-pocketed customer base (e.g., the petroleum refining industry). The potential to create a permanent pricing floor for YG and tallow across the world also exists.

For the rendering industry, the production of AGTANE in sufficiently large quantities presents an effective means to help keep YG prices from falling below a minimum threshold (approximately $0.08/lb.).

Based on its bottom line appeal, AGTANE production is expected to be readily implemented in major urban areas where large rendering operations are located within 50 miles of petroleum refining facilities. The success of a tabletop presentation conducted at the first World Renderers Organization meeting in California last October indicated that renderers worldwide are keenly interested in this technology.

Figure 1. CANMET Technology for Producing AGTANE



What is Agtane?

AGTANE is not a biodiesel, but a fuel additive. Conservative economic models indicate that for mass production plants (>315,000 gallons/year) it could be profitable to convert YG to AGTANE. Three economic models were prepared for AGTANE production. The renderer-only model is shown in Table 1.

There are several reasons why this product could yield high profits. These reasons fall into four categories: engine performance; product distribution; environmental; and bottom-line. Some of these reasons are listed below by their respective categories.

(1) Engine Performance

Biodiesel blends typically require more algae and/or bacteria-killing additives than regular diesels. AGTANE blended diesel will not require fuel suppliers to increase the use of algae and/or bacteria killers.

Being a collection of long-chain paraffins, AGTANE has a field tank storage life equal to or superior to currently commercialized diesel fuels. It reacts to traditional or plastic fuel storage materials the same way as commercialized diesels. Diesel engines were designed to burn fuels that include paraffins, which are normally found in commercial diesel fuels.

AGTANE has repeatedly shown to have cetane values of over 100, before blending, and have excellent physical and chemical characteristics that make it an ideal blending stock. Table 2 compares AGTANE with

Table 1. Renderer-Only Plant Model

Outlays		
Yellow Grease[1]	=	$0.78/gallon of AGTANE
Storage	=	$0.01/gallon ”
H_2	=	$0.18/gallon ”
Heat (Steam)	=	$0.04/gallon ”
Operating Costs	=	$0.10/gallon ”
Capital Costs	=	$0.15/gallon ”
Overhead Charge	=	$0.03/gallon ”
Royalties[2]	=	$0.06/gallon ”
TOTAL	=	$1.35/gallon of AGTANE
Revenues		
AGTANE	=	$1.287/gallon of AGTANE
Heavy Cut	=	$0.273/gallon ”
TOTAL	=	$1.560/gallon of AGTANE
Gross Profit		
$\triangle_p$	=	$0.21/gallon of AGTANE

[1]Delivered to plant (at $0.08/lb. and using 1.3 gallons of yellow grease to make one gallon of AGTANE)
[2] To CANMET ($0.06/gallon of AGTANE)

California Air Resources Board (CARB) specified diesels.

(2) Product Distribution

AGTANE will be distributed through existing refined petroleum products distribution channels. Refiners exposed to AGTANE consider it to be a “synthetic diesel.” California refiners have indicated they would buy the product now if it were commercially available. They currently buy a similar, although not as high quality, low sulfur diesel blending stock from Malaysia. The same refiners have indicated that they would support an AGTANE demonstration project once a small pilot plant has been field proven.

(3) Environmental

With AGTANE, there are no engine emission trade-offs (Nox versus PM10 and/or hydro-carbons), no water is needed for production, and there are no known environmental issues.

(4) Bottom-Line

AGTANE yield is not affected by the YG’s free fatty acid (FFA) content.

A by-product of AGTANE production is a low sulfur, heavy oil cut that is readily marketable or that can serve as source material for hydrogen (necessary to make AGTANE). The entire manufacturing process can ultimately be made H_2 self-sufficient.

Production Potential

It is thought that annual production of AGTANE in the United States could readily exceed 21 million gallons. In Southern California alone, about 330,000 gallons of this product can be steadily produced each month, replacing an equivalent amount of petroleum derived diesel.

Last summer, CANMET commissioned research that proved synergy between AGTANE and traditional cetane improvers, thus increasing its value. Baker Commodities in Los Angeles, CA, contributed YG and Tosco Oil provided CARB unadditized diesel to CANMET, which made AGTANE from YG and blended specified amounts with Tosco unadditized diesel. Cetane tests were conducted by AET, Ltd. The “traditional” cetane improver used by AET was Octel CI-0801.

Figure 2 shows how AGTANE linearly enhances the cetane value of an unadditized blend while Figure 3 shows how a traditional cetane improver effects eventually flattens out. The test results indicated that

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Table 2. Characteristics of Agtane Produced from Feedstocks

Feed		CARB Fuel Specs.	Tallow	MR-001299 Yellow Grease
Yield, kg/100 kg feed			80.4	76.6
Density at 25°C, kg/m^3	ASTM D4052		774.2	776.9
API gravity, °API	ASTM D1250	33-49	49.31	48.74
Elemental analysis				
C, wt%	ASTM D5291 (method B)		85.6	85.1
H, wt%	ASTM D5291 (method B)		15.1	15.0
N, ppm	ASTM D4629	10 max.	<0.1	<0.3
S, ppm	ASTM D2622	500 max.	32.0	21.0
Kinematic viscosity @40°C, cSt	ASTM D445	2.1-4.0	3.093	3.39
Flash point (P.-M.), °C	ASTM D93	54.4	106.0	138.5
Cloud point, °C	ASTM D5773		16.6	21.2
Total acid number, mg KOH/g	ASTM D664		0.07	<0.05
Cetane number	IQT	48 min.	98.6	102.3
Lubricity test, micron	BOTD Wear Scar Diam.		615.1	682.8
Simulated distillation, °C	ASTM D2887 (or D86 corr.)			
IBP		171-216	149.5	196.0
10		204-254	271.4	273.5
50		243-293	304.6	309.0
90		288-321	319.3	325.0
FBP		304-349	335.8	380.5

Agtane *Continued from page 13*

AGTANE:

(1) Linearly raised the cetane of unadditized Tosco diesel without a top-end limit[1];

(2) Can linearly raise the cetane of "non-responsive[2]" diesel blends;

(3) Is synergistic with traditional cetane improvers;

(4) Has a low sulfur content (~15 ± 5ppm[3]);

(5) Increases end-product volume by the added AGTANE volume;

(6) Can finish the refining process for an unadditized diesel at a lower cetane value than previously possible; and

(7) Allows diesel blenders/ traders to buy and profitably resell lower cetane "non-responsive" diesel stock.

A consortium is being formed to undertake a three-step validation and technology transfer process and a campaign to make the this new technology available worldwide is being organized with initial efforts directed towards the North American and Western Europe markets. ❖

[1] The cetane value enhancing effects of traditional cetane improvers level off at some point, after an eight or nine point rise in cetane value.

[2] "Non-responsive" means that certain diesel stocks turn out not to respond well to increasing cetane value when traditional cetane additives are mixed in.

[3] 15-ppm max. S_2 in on-road diesel is a South Coast Air Quality Management District requirement by 2005.

Figure 2. Impact of Yellow Grease-derived AGTANE on Diesel Cetane Number

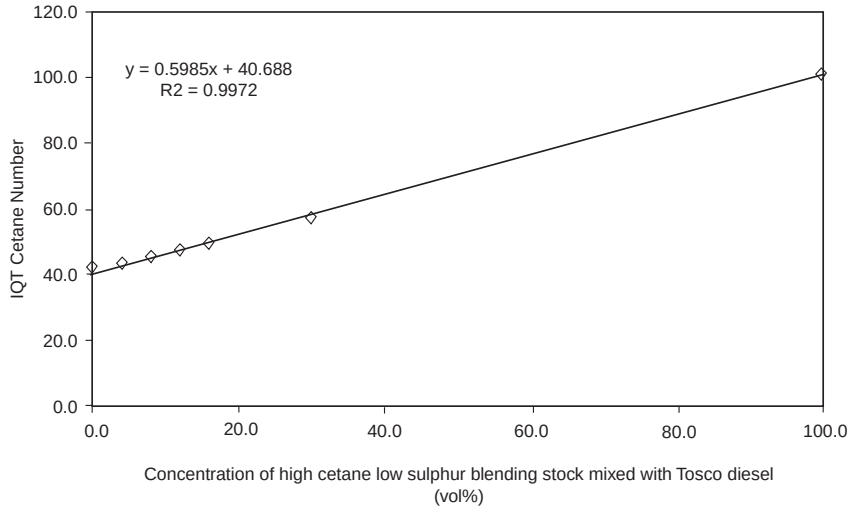

Figure 3. Response of Tosco Diesel Fuel to Commercial Cetane Improver