Director's Digest
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These are exciting times for alternative sources of energy. Especially so for the renewable, recyclable sources often referred to as alternative fuels. The primary sources of feedstocks include all of the animal fats, recycled cooking oils/restaurant greases, vegetable oils and ethanol as derived from grain. Though a number of additional cellulistic resources such as those derived from lignin biomass materials are often referenced, the above feedstocks are currently available with the technology and infrastructure already developed for their production and certainly will be renewably available based on crop and animal production practices.

Segments such as the ethanol industry have grown to over 2 billion gallons produced annually. It is estimated that 18-20 new ethanol plants will come into production this year. Projected production could reach 5 billion gallons annually. That acceptance, current growth and interest has taken some two to three decades. The stakeholders for biodiesel comprising the potential feedstocks and infrastructure has lacked the synergism to fully exploit the benefits and biodiesel potential in what could have been a more rapid adoption rate. Feedstock specificity in defining biodiesel has hampered the understanding within many entities, regulatory agencies, legislators and end users. Feedstock neutrality remains as a controversy that is in need of resolution for biodiesel to become a "truck/tractor side" term like ethanol has to the gasoline industry.

Renewable and recyclable sourced fuels must be and now are recognized as being an important part of the US as well as the global energy plans. An increasing concern exists regarding economic, air/water quality and energy security issues related to the nations continued reliance upon fossil-derived fuels. The concern is particularly evident as it involves our dependence on imported petroleum. This nation has a trade deficit of

over 490 billion (US$) per year with respect to imported petroleum. Carbon emissions and other highly toxic chemicals produced as a by-product of fossil-fuel combustion have been shown to significantly contribute to human health, urban smog and perhaps global warming. The percentage of US energy needs met by imported oil has been a linear increase beginning in 1973 at 25%, increasing to 35% in 1980, 47% in 1990, 58% in 2000 and projected to be at least 69% in 2010. The recently revised national energy policy has recognized the importance of renewable energy sources with greater interest than at any other time. A historical review however portrays an interest level that has been somewhat cyclical towards renewable/alternative fuels rather than a sustaining research, technology development and regulatory attitude that encourages commercialization. It would therefore be projected that enhanced exploration and sourcing of petroleum based sources will continue to command a significant strategic segment within the overall national energy plans and policies. In reality alternative fuels must in the foreseeable future be considered as supplemental and ancillary energy resources to those currently available. It has been projected that up to 7-8% of the current demand could be sourced from the renewable, recyclable resources previously referenced. This level of contribution however is extremely significant when reviewing the very fickle supply/demand relationship that exists with petroleum based products. Additionally the bioenergy sources will undoubtedly be used as resources for blending with fossil fuels for not only extension, but also enhancement of fuel quality and environmental benefits. Ethanol is again an excellent example when used as a 10% blend into gasoline.

As alternative fat and oil fuel sources, the US produces an approximate 23.7 billion pounds of plant oils and 11.6 billion pounds of animal fats and recycled cooking oils (USDA Averages 1995-2000) annually as illustrated below.

The total production of US fats and oils are detailed as follows:

Vegetable Oil Production (Billion Pounds)	
Soybean	18.340
Peanuts	0.220
Sunflower	1.000
Cottonseed	1.010
Others	0.669
Corn	2.420
Total	23.659

Animal Fats (Billion Pounds)	
Edible Tallow	1.625
Inedible Tallow	3.859
Lard & Grease	1.306
Yellow Grease	2.633
Poultry Fat	2.215
Total	11.638

As can be noted, soybean oil as a category comprises the largest resource of a specific fat/oil. Domestically soy oil represents approximately one-half (52%) of total resources. Animal fat resources and recycled cooking oils/restaurant greases comprise 33% of the total potential resource. Both soybeans and thus soy oil production as well as the animal supplies are expected to expand in ensuing years. Additionally soy oil supplies from South American production is projected to continue to expand.

Biodiesel has taken a more prominent position in the world of fuels most recently. Its use and potential as a renewable source of fuel for diesel engines for transportation purposes; trucks, buses and tractors is now well recognized. Petrodiesel fuel usage annually in the US is approximately 54 billion gallons. The major increases in fuel usage have been the market segment delivered by the heavy and light diesel transport truck segment. Over 95% of all US freight is delivered by trucks powered by diesel. This usage is estimated to require approximately 39 billion gallons of the

annual total. Additionally this is the segment that contributes heavily to the environmental challenges of our urban and inter-cities. Though on-road usage is a primary utilization for biodiesel, stationary engines used in other industrial applications, power generation, mass transit, commercial marine, home heating, all offer significant opportunities as an alternative fuel use.

Biodiesel is defined as a monoalkyl ester of long-chain fatty acids that are derived from animal fats, vegetable oils or recycled cooking oils/restaurant grease. Biodiesel is technically an oxygenated fuel produced by the reaction of a triglyceride (fat or oil) with an alcohol in the presence of a catalyst. The primary catalysts used currently are sodium hydroxide and potassium hydroxide though research and emerging technologies are continuing to incorporate process efficiency improvements and product quality in which catalysts are an important contribution component of process research. The resultant fat/oil, alcohol, catalyst reaction produces alcohol (methyl) esters (biodiesel) and glycerine. The combination of 100 units of triglycerides with 10 units of methanol result in 100 units of methyl esters and 10 units of glycerine. Thus a 1:1 reaction rate of triglycerides into biodiesel is achieved with the most efficient processes and results in approximately 7.35 pounds of fat/oil converting to a US gallon of biodiesel.

It has been extremely important that all biodiesel production regardless of process and origin of feedstock be quality fuel meeting established specifications. This characteristic has been important during the initial research stage, demonstration stage and continuing into the commercialization stage. It is an increasing concern now that there are more evaluators and perhaps critics making judgements relative to fuel quality. Engine manufacturers and auto/trucker makers have generally been supportive of biodiesel but are seeking a continued assurance of quality. The American Society of Testing and Materials (ASTM) is a primary organization that reviews test procedures and establishes specifications for a variety of products including fuel. Final ASTM specifications for 100% biodiesel (neat biodiesel) have recently been approved. ASTM D 6751-2 will now govern the approved specifications for biodiesel. Though the publishing of the properties and limits cannot be officially published until final registration, expected to be published by April 2002, the basic approved changes from the Provisional Specifications (PS121) are as follows.

BIODIESEL SPECIFICATIONS

(For pure mono alkyl esters of long chain fatty acids derived from renewable lipid feedstocks)

Property	ASTM Method	Limits	Units
Flash Point	D93	100.0 min	°C
Water & Sediment	D2709	0.050 max.	vol. %
Carbon Residue, 100% sample	D4530[1]	0.050 max.	wt. %
Sulfated Ash	D874	0.020 max.	wt. %
Kinematic Viscosity, 40°C	D445	1.9 Ñ 6.0	mm2/sec(cSt)
Sulfur	D5453	0.050 max.	wt. %
Cetane	D613	40 min.	
Cloud Point	D2500	By Customer	°C
Copper Strip Corrosion	D130	No. 3b max.	
Acid Number	D664	0.80 max.	mg KOH/g
Free Glycerin	GC	0.020 max.	wt. %
Total Glycerin	GG	0.240 max.	wt. %

[1] Method in Development

Expected Changes for ASTM D6751-2

-Flash point will be changed to 130°C minimum.
-Cetane changed to 47 minimum.
-A phosphorus specification will be added with D 4951 test method and 10 ppm maximum.
-A vacuum distillation specification will be added using test method D 4951 and 360° maximum at T90.
A copy of the final ASTM D 6751 document will not be published or available until April 2002.

The sulfur level within the approved specifications is 0.050% maximum (500 parts per million). This is the currently approved maximum for diesel fuels as well as biodiesel. A mandated reduction in sulfur levels has been published by the Environmental Protection Agency (EPA) requiring that a 15 ppm level be met for all fuels by 2007. Thus there are immediate plans to re-ballot a second grade of biodiesel at 15 ppm sulfur content. The proposed test method of D-5453 is not readily available from all petroleum testing laboratories. Additionally there has been considerable variation within the test methods used for sulfur determination in both biodiesel and fats/oils raw feedstocks when comparing D-4294, D-2622 and D-5453 methods and laboratories. Biodiesel contains a very low level of sulfur compared to diesel fuel. Thus the schedule for meeting the 2007 mandates will be much easier for biodiesel when compared to the petroleum based fuels. Lowering sulfur in diesel fuel becomes concerning to engine and fuel-injection manufacturers that the changes will negatively affect fuel lubricity and have damaging consequences to their equipment. Biodiesel being low in sulfur can, even in low-blend concentrations improve the lubricity of diesel fuel to acceptable levels. Sulfur levels in both diesel and biodiesel will be a debatable issue during the next five-year conversion process but environmentally is an important issue.

To supplement the attention for quality, a National Biodiesel Accreditation Commission (NBAC) has been established by biodiesel producers and marketers. It is designed to help assure that biodiesel meets the ASTM standard throughout the production distribution and marketing functions. These systems include but are not limited to sampling, testing and documentation of biodiesel specifications.

The current US biodiesel market penetration is still relatively small. During the past year a 25 million gallon usage was estimated which represents a 350% increased demand over 2000. There are currently fourteen biodiesel suppliers in the US but several others with plans or are evaluating plans both within the US and Canada are known. There are several stimulating factors for the enhanced commercialization as well as for its usage. Several major farm organizations have actively promoted and developed infrastructures to market the fuel. Growmark, Inc. in Bloomington, Illinois offers on-farm delivery of fuel blends that include up to 20% biodiesel. Most recently the cooperative has made biodiesel available at pumps throughout their mid-west marketing area.

Additionally several engine and equipment manufacturers have endorsed the use of biodiesel for their diesel-powered products. Notably John Deere recently made that announcement. However John Deere's announcement statement referenced the sanction of only soy based biodiesel. But

further officially approved the use of biodiesel that meets national standards in all of its diesel-powered products. It is hoped that engine and equipment suppliers understand that a substantial number of their equipment are likewise purchased and used by livestock, poultry producers and the animal industries sector. This is an excellent example of the confusion developed within the marketing arena for biodiesel. Soy diesel, being an original term for biodiesel, has wrongly been confused with the mere mixing of soy oil into diesel fuel. A practice that should not be followed. The biodiesel process removes the glycerine component, which can damage engines with extended use. Additionally there are a number of state and federal legislative initiatives that are being promoted using definitions outside the scope of feedstock neutrality. Actions that are not conducive for acquiring the support for a unified agricultural position. Whether the legislation is pointed at blend level mandates, sales or excise tax relief, state/federal fleet mandates, or other production or marketing incentives those feedstock stakeholders excluded from the legislative initiatives must unfortunately counter with its opposition. Biodiesel could become a very fragmented industry with opposing special interest groups hindering the adoption process and reducing the opportunities that biodiesel currently commands.

There are several pending legislative initiatives that could be quite stimulatory to the promotion of biodiesel research, technology development and expansion, the expansion of the production and marketing infrastructure and the general acceptance of its use as a fuel. Senate Bill S 1058 (Hutchison/Dayton) and supported heavily by Lincoln & Grassley is a referenced example. A proposed bill that would provide for tax relief incentives for the use of biodiesel as a low blend mandate and tax incentives currently proposed at 1 cent for each 1% blend level up to a maximum of 20 cents. This legislation is a focus of attention, having undergone several modifications and transformations into a Comprehensive Energy Program that could incorporate Tax Provisions, Renewable Standards, Alternative Fuel Standards and other special interest groups initiatives into the legislative. Unfortunately the current wording of the proposed legislation excludes animal fats and recycled cooking/restaurant greases or 32% of the potential that currently is available for renewable/recyclable biodiesel production.

The availability for government crop subsidies and incentives has likewise been very limited for feedstock sources other than for oil seed and grain crops. An example of magnitude was a review of the 2001 gross income derived from an Indiana farm. Gross income generation from soybeans accounted to 61.9% from the actual sale of the soybeans while 38.1% was derived from Loan Deficiency Payments (LDP), Production Flexibility Payments and Market Loss Assistance Programs providing 30.4%, 3.6% and 4.1% respectively.

The US Department of Agriculture has recently provided for the inclusion of animal fats, yellow grease, recycled cooking oils/restaurant greases as eligible commodities for the production of biodiesel. Production increases above the previous year of biodiesel produced from these feedstocks will now be eligible for commodity payments. The formula for determining the credits derived however favors vegetable oils by approximately 2.5 times that for other feedstocks. Last year USDA reported an increase in output of 141.3 million gallons of ethanol and 6.4 million gallons of biodiesel produced nearly exclusively from soy oil as a result of last years program that included primarily grains and oil seed crops. The animal fat derived resources are important to the full contribution that biodiesel has to provide to meeting the established mission for our country to become more self sufficient in energy demand. Yes these are exciting times for alternative fuels. The

excitement is real and can be fully realized now. It is somewhat unfortunate that the inter-relationship and very close synergism that exists between animal and crop production can't be accepted by the producer groups. The very high utilization of the grain produced ultimately is for animal production. This is true whether it is consumed as grain or the byproducts resulting from further processing such as distillers grain and gluten feed. Currently 85% of the soybean meal derived from producing the 11 pounds of soy oil from each bushel of soybeans is used to produce livestock and poultry. Can it not be accepted that this same livestock and poultry are the same that generates the 11.6 annual billion pounds of animal derived fats? In conclusion, animal fats and the recycled oils that are primarily processed by the rendering industry are alternative and renewable bioenergy 2002 resources. This article has not addressed their important value as alternative fuels. FPRF in cooperation with the University of Georgia has a project underway to define the energy and pollution reduction benefits of tallow, choice white grease, poultry fat and yellow grease. A project that has received global attention and will be detailed upon its conclusion through FPRF publications.