



Biomass Oil Analysis

Course Number: CH-02-600

PDH: 9

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Course Author: Mathew Holstrom

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Biomass Oil Analysis and Application Course

Introduction:

In this course, we'll explore the groundbreaking research and development efforts led by the United States Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) and the Office of the Biomass Program (OBP). Our journey will delve into strategies aimed at reducing dependence on foreign oil and fostering the growth of a domestic bioindustry.

Course Objectives:

By the end of this course, you will:

1. Understand the critical role of commercial biorefinery technology and biobased products in achieving energy independence.
2. Learn about the potential of biomass oils, including animal fats, fish and poultry oils, plant oils, and recycled cooking greases, in displacing petroleum.
3. Gain insights into the various applications of biomass oils, such as boiler fuels, biodiesel, and bio-distillates.
4. Explore the significant contributions of the oleochemical industry and the potential for glycerin by-product utilization.

Module 1: Introduction to Biomass Oils

- Overview of biomass oils and their role in energy sustainability.
- Understanding the molecular structure and types of biomass oils.

Module 2: Biomass Oils in the Market

- The potential of biomass oils to displace up to 10 billion gallons of petroleum by 2030.
- Commercial applications: Direct use, biodiesel production, and bio-distillates.
- The importance of blending biomass oil fuels with petroleum for optimal performance.

Module 3: The Oleochemical Industry

- An exploration of the oleochemical industry's current status, including its capacity to produce biobased products and the competitive edge over petrochemicals.
- The significance of methyl esters and glycerin in the industry.

Module 4: Enhancing Glycerin Value

- Understanding the by-product glycerin and strategies to improve its quality and market value.
- Federal investments in catalyst R&D for biodiesel and oleochemical production.

Module 5: Policy and Investment for Biomass Oils

- The impact of federal investment and policies on biomass oil feedstock costs and industry expansion.
- Strategies for promoting biomass oil fuels and products through incentives or mandates.

Module 6: Research and Development Priorities

- Prioritizing R&D investments for maximum impact on biomass oil utilization.
- Detailed exploration of bio-distillation, CO₂ oil extraction technology, and the development of glycerin coproducts.

Module 7: Future of Biomass Oils

- Innovations in oilseed crop improvements and microorganism-based oil production.
- Vision for biomass oils in displacing petroleum and enhancing the bioindustry.

Conclusion:

This course will equip you with a comprehensive understanding of the potential of biomass oils in transforming the energy landscape. Through a blend of theoretical knowledge and practical insights, you'll be prepared to contribute to or initiate projects focused on biomass oil research and development, aligned with the goals of reducing dependency on foreign oil and spurring the growth of the domestic bioindustry.

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Bio-distillation process optimization	RFP										
Improved oil extraction technology	RFP										
Develop industrial products from meal	RFP	RFP									
Improved glycerin refining technology				RFP							
Coproducts from glycerin/glycerol					RFP	RFP					
Develop closed loop oil producing microorganisms						RFP					

Table 1. Biomass Oil R&D Project Schedule

Benefits and Outcomes The result of OBP investment in biomass oil R&D is to create the opportunity to displace up to 10 billion gallons of petroleum diesel per year by 2030. The resulting fuel costs will appear reasonable to the consumer in blends of 5% (5 to 10 cent per gallon premium). Currently, blends of 2% or more biodiesel are marketed as premium fuels, where the value of the fuel benefits offset the additional costs. Higher blends, such as B20 can continue to be marketed where global warming, emission, or other environmental benefits offset the cost of the fuel. At least two different fuels are available as vehicles for this program, providing flexibility and insurance. There are only minor technical barriers associated with the fuels themselves that will not pose significant barriers to market expansion.

ACRONYMS AND ABBREVIATIONS

A	acre
ARS	USDA Agricultural Research Service
ASA	American Soybean Association
ASTM	American Society for Testing and Materials International
B100	pure biodiesel, 100% long chain mono alkyl esters of fatty acids
B20	20% biodiesel, 80% conventional diesel
B2	2% biodiesel, 98% conventional diesel fuel
Bbl	barrel
BSE	bovine spongiform encephalopathy
CI	Compression ignition engine (diesel engines)
CCC	USDA's Commodity Credit Corporation
DDGS	distiller's dry grains with solubles
DOE	United States Department of Energy
EERE	Energy Efficiency and Renewable Energy Office of DOE
EIA	Energy Information Administration of the DOE
EPA	United States Environmental Protection Agency
ERS	USDA Economic Research Service
FA	fatty acid
FAME	fatty acid methyl esters
FCVT	FreedomCAR and Vehicle Technologies
FDA	Food and Drug Administration
FFA	Free fatty acid
Gal	gallon
GMO	genetically modified organism
lb	pound
MIU	Moisture, impurities and unsaponified materials
NBB	National Biodiesel Board
NREL	National Renewable Energy Laboratory
OBP	Office of the Biomass Program
RBD	Refined bleached and deodorized
R&D	research and development
SVO	Straight vegetable oil
USB	United Soybean Board
USDA	United States Department of Agriculture
WVO	Waste vegetable oil
YG	Yellow grease

1 GOALS AND OBJECTIVES RELATIVE TO THE OIL PLATFORM ANALYSIS

The United States Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) invests in research to achieve the following goals:

- Dramatically reduce, or even end, dependence on foreign oil
- Spur the creation of a domestic bioindustry.

The Office of The Biomass Program (OBP) within EERE invests in R&D to support those goals and to achieve the following outcomes¹:

- Establish commercial biorefinery technology by 2010
- Commercialize at least four biobased products.

These outcomes can be achieved by concentrating investments where they will produce the highest likelihood of success and/or the largest impact. OBP faces a large portfolio of R&D options with limited resources. As a result, only those investments that offer the largest benefits can be funded. This analysis provides inputs for those decision-making processes.

The biomass feedstocks evaluated in this report are lipids from animal fats, fish and poultry oils, plant oils, and recycled cooking greases. These feedstocks shall be referred to as biomass oils. The compound of interest contained in biomass oils is triacylglycerol (triglyceride in common usage). Most biomass oils contain about 95% triglycerides with small amounts of phosphatides, sterols, antioxidants, and other minor compounds. Triglycerides are composed of three long hydrocarbon chains called fatty acids (containing 6 to 24 carbons) with carboxyl ends attached to a glycerol molecule. Triglycerides are glycerol esters of fatty acids. When the fatty acids become disconnected from the glycerol backbone, they are called fatty acids or free fatty acids depending on the audience.

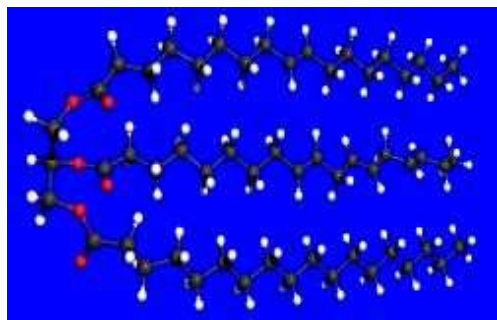


Figure 2. Triglyceride Molecule

As we shall see, biomass oils can displace imported petroleum. The key questions with respect to this achievement are:

¹ OBP also has goals specific to technology development in sugars and syngas that are not relevant to this discussion.



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