



Biodiesel from Biomass

FACT SHEET 5.7

INTRODUCTION

Biodiesel is a transportation fuel made from renewable biological resources such as vegetable oils, plant materials and animal fats. It is biodegradable, nontoxic, and yields very low emissions¹. Currently, only 10 percent of biodiesel can readily be made from woody biomass. This is the 10 percent of biodiesel that is methanol, an additive used as a thinning agent. The other 90 percent, which is oil, is generated from food-based feedstocks. Creating biodiesel entirely from woody biomass will require the development of new technology. However, once the technology is developed, the resulting product promises to be competitive if not better than today's biodiesel.

HISTORY OF BIODIESEL While the technology to run engines on bio-diesel has existed for more than 100 years, the advent of cheap petrol-based fuels made bio-diesel unnecessary, for the most part. An increased focus on biodiesel largely results from its success in Europe and the recent spike in crude oil prices. The crop of choice in Europe has been rapeseed, and the European Union has implemented subsidy programs for farmers growing oilseed crops to promote biodiesel production.

In the United States, biodiesel is unlikely to completely replace petroleum-based diesel. This is largely due to raw material and production costs as well as the limited availability of fat and oil¹. Even if all of the vegetable oil currently produced in the United States, about 3.1 billion gallons per year, went into

biodiesel production, plant-based biodiesel production could provide only 6.4 percent of the nation's annual diesel consumption of 45 billion gallons². Introduction of biodiesel as a blend with conventional diesel fuel is a more feasible goal in the United States. It could have significant benefits in areas where the environment is sensitive to disruption by conventional diesel emissions or spills.

In addition to supply issues, current raw material as well as production costs for biodiesel are extremely high. The cost of raw materials could be significantly lowered if recycled, good quality cooking oils were readily available². Europe has been able to overcome this problem by offering incentives encouraging the production of and use of biodiesel.

HOW IS BIODIESEL MADE? Although biodiesel can be made through several processes, transesterification, is currently the method of choice. Transesterification, also known as alcoholysis, is a reaction that occurs between plant oils or fats and alcohol, in the presence of a catalyst. It produces fatty acid, methyl esters¹. Alcohol needed for the reaction is readily available from biomass, natural gas usage, or coal. Oils that are processed into biodiesel include soybean, sunflower, canola, and industrial rapeseed². If the reacted oils have the correct carbon chain length, the fatty acid methyl esters will have chemical characteristics similar to those of conventional diesel fuel when they combust in modern diesel engines (*Image 1*).

Cassidy, P.; S. Ashton. 2007. Biodiesel from Biomass. Pages 187–188.

In: Hubbard, W.; L. Biles; C. Mayfield; S. Ashton (Eds.). 2007. Sustainable Forestry for Bioenergy and Bio-based Products: Trainers Curriculum Notebook. Athens, GA: Southern Forest Research Partnership, Inc.



source: University of the West of England



Image 1. Rapeseed

A recent technological advance developed at the University of Wisconsin shows new promise for cellulosic biodiesel, which is a diesel made from all dry plant matter rather than the small portion that is fatty acids. What makes this advance so attractive is that the 90 percent of dry biomass currently not suitable for production of biodiesel would become suitable. Moreover, the process is exothermic, meaning it requires very little extra energy. This is important because the largest cost in the current biofuel refining process is related to energy needs³.

Biodiesel, today, is usually mixed with petroleum-based diesel fuel in a ratio of 20 percent biodiesel to 80 percent diesel fuel (B20). The U.S. Department of Energy has moved to the rule-making process for inclusion of B20 as an approved alternative fuel under the Energy Policy Act of 1992. If this commercial acceptance occurs in the private sector, fleets of small diesel engines will be able to meet more stringent alternative fuel guidelines with biodiesel.

SUMMARY AND CONCLUSIONS

Biodiesel, like ethanol, is important because of its environmental benefits. One advantage of biodiesel over petroleum-derived diesel is the virtual absence of sulfur and aromatic compounds⁴. Further, combustion of biodiesel produces lower emissions of carbon monoxide, unburned hydrocarbons, and particulate matter than combustion of petroleum-based diesel³. Consideration of emissions is particularly important in urban areas suffering from poor air quality. Biodiesel may be valuable in the future because the fuel can be used in today's diesel engines without modification and in various blends without negative impacts on engine performance⁵.

For more information, please refer to the Encyclopedia of Southern Bioenergy at <http://www.forestencyclopedia.com/Encyclopedia/bioenergy>.

ENDNOTES

- 1 Ma, F.; Hanna, M.A. 1999. Biodiesel production: a review. *Bioresource Technology*. 70 (1999): 1–15.
- 2 Harsch, J. 1992. New industrial uses, new markets for US crops status of technology and commercial adoption. Washington DC: Cooperative State Research Service.
- 3 Technology Review. 2005. Biodiesel: A new way of turning plants into fuel. <http://www.technologyreview.com/>. [Date accessed: October 1, 2006]
- 4 Abbe, B. 1994. The expanding array of environmentally improved new use products from America's farms. New Uses Council's 1994 Agriculture Summit on New Uses. Washington DC.
- 5 Hayes, D.F. 1995. Biodiesel: Potential economic benefits to Iowa and Iowa soybean producers. Ames, Iowa: Center for Agriculture and Rural Development.

Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement implied.

