Biodiesel Safety and Best Management Practices for Small-Scale Noncommercial Use and Production

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SAFETY GEAR SUMMARY

The following gear should be on hand each time you produce biodiesel:

- Chemical-resistant gloves (butyl rubber is best for methanol and lye)
- Chemistry goggles (indirect vented) and face shield
- Dust mask or cartridge respirator
- Eyewash bottle with saline solution
- Small spray bottle with vinegar for neutralizing lye spills
- Access to running water
- Telephone in case of emergency and emergency telephone numbers
- Fire extinguishers (ABC or CO_2)
- Absorbent material and spill-containment supplies

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INTRODUCTION

This publication addresses processing and safety issues associated with making biodiesel fuel. Biodiesel is a clean, renewable fuel that can be made from various biomass oil feedstocks such as waste vegetable oil, yellow grease, animal fats, and virgin vegetable oils. Small-scale biodiesel production has been growing due to higher fuel prices, a desire for energy independence, and interest in environmentally friendly renewable fuel production.

Although the biodiesel manufacturing process is fairly straightforward, there are several aspects of biodiesel production that need careful attention to detail for a productive, safe, and environmentally sound practice. First, some chemicals used could pose serious risks to the operator or to the environment, unless the proper precautions are taken for storage, process safety, handling, ventilation, and use. Second, disposal of glycerol by-product and waste water generated from biodiesel production could cause environmental harm, unless approved practices are used. Finally, operators need to pay close attention to the quality of the biodiesel produced and proper storage to avoid costly engine problems or excessive emissions during use.

Most enthusiastic newcomers to biodiesel production will find that successfully running a safe and responsible operation is not as easy as it looks. Production of biodiesel on a small-scale carries inherent risks, and careless producers are likely to have mishaps. While the obvious goal of all producers should be to minimize mistakes, it is also important to know how to deal with these mistakes and respond appropriately. Knowledge, attention to safety, and advanced planning are the best approaches to preventing serious accidents.

The objective of this publication is to review some of the accepted practices associated with small-scale biodiesel production to make it a safe, environmentally sound practice that generates a quality product. Prospective biodiesel producers are also encouraged to use this information as they decide whether or not to begin making biodiesel. For the preparation of this document, we have solicited input from a variety of experts including chemists, agronomists, environmental engineers, regulators, and educators in the field of small-scale biodiesel production and use. Please note that this booklet provides references to state regulations for Pennsylvania; biodiesel producers in other states are encouraged to check with their state regulators to ensure that they are in compliance with all regulations. A glossary is provided at the end of the booklet which defines terms used throughout the publication.

FUEL OPTIONS FROM BIOMASS OIL FEEDSTOCKS

While early diesel engines demonstrated an ability to run on crude plant-based oils, modern diesel fuel systems are designed for efficiency and low engine emissions and burn fuels of a relatively low viscosity. At average fuel tank temperatures, unconverted vegetable oils are too viscous (too thick) to properly burn in modern diesel engines (especially those with common rail fuel injection systems). Those who wish to run their diesel equipment on raw vegetable oil, used cooking oils, animal fats, or fuels derived from these have the following options: (1) convert the oil to biodiesel, or (2) convert the diesel's fuel system to run heated oils as illustrated below (Figure 1).

NOTE: For simplicity, the general term "vegetable oils" is used and includes virgin vegetable oils, used cooking oil, and rendered animal fats. Some researchers have experimented with blending unconverted vegetable oils into diesel fuel as a fuel additive or extender. While some diesels may tolerate low percentage (5 percent) blends of vegetable oil in diesel, this information is engine-specific, and higher-percentage blends are not advised. In a different approach, some commercially available products promote blending used cooking oils with unleaded gasoline and additives to reduce the viscosity. This practice is not recommended by the authors of this booklet. Numerous studies by the Department of Energy and others have demonstrated that the use of high-viscosity unconverted oils at levels as low as 10 percent may cause engine wear, injector deposit formation, and premature engine failure. Anecdotal reports by diesel service personnel also report several cases of problems with injector pumps and other parts linked to the use of high-percentage blends of unconverted vegetable oils with diesel fuel. Engine manufacturers may not honor warranties if raw oils or any other fuel products not meeting fuel quality specifications are used as fuel.

FIGURE 1