



Best Practices of Municipal Biodiesel Production

Dear Reader:

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We hope this information will be useful to you; reference to it will assist you with many of the questions that will arise in your tenure with municipal government. However, the *Tennessee Code Annotated* and other relevant laws or regulations should always be consulted before any action is taken based upon the contents of this document.

Please feel free to contact us if you have questions or comments regarding this information or any other MTAS website material.

Sincerely,

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Best Practices of Municipal Biodiesel Production

Reference Number: MTAS-737

The city of **Gadsden, Alabama** initiated a WVO recycling program and biodiesel production program in the fall of 2007. Like many municipalities, it was faced with rising fuel costs. It was also faced with another common problem of municipalities: high maintenance costs in the wastewater treatment system due to grease from households and restaurants. After expressing its intention to start a recycling and biodiesel production program, the city was designated as an Auburn University Energy Partner. In this relationship, personnel from the Gadsden municipal fleet worked with personnel from Auburn University's Center for Bioenergy and Bioproducts and the Alabama Cooperative Extension System to establish the biodiesel production system. Gadsden is currently recycling used cooking oils that are available from local restaurants and households to produce biodiesel, and as a result minimizing fleet fuel expenditures and wastewater treatment system maintenance. Additional financial support for this program was provided by the Energy Division of the Alabama Department of Economic and Community Affairs.

Best Practices in Biodiesel Production: Program Initiation

Reference Number: MTAS-1485

At the start of Gadsden's program, the biodiesel processing equipment and associated oil collection and processing equipment were bought by the city. This equipment included the following major items:

- Biodiesel processor capable of producing 55-gallon batches of biodiesel (manufactured by Biodiesel Logic, Inc.);
- Four 275-gallon chemical storage "totes" for storing WVO before processing;
- Two 150-gallon fuel tanks, pumps, and meters for storing and dispensing finished biodiesel;
- 20 55-gallon steel drums for WVO collection at restaurants
- 4,500 one-gallon plastic jugs for residential WVO collection;
- Seven collection bins for residential WVO jug
- Miscellaneous lab supplies for titration of WVO;
- Expendable supplies for biodiesel production (methanol, sodium hydroxide catalyst).

The collection bins for residential WVO jugs were built by personnel in the fleet management group in Gadsden. Other municipalities have purchased similar commercially available units. The one-gallon jugs were fitted with pre-printed labels that have information on procedures for recycling the WVO.

Best Practices of Biodiesel Production: Program Operation

Reference Number: MTAS-1486

When Gadsden's program started, 55-gallon drums were distributed to participating restaurants. Fleet management personnel checked the drums once each week, and generally picked them up when the drum contained about 35 gallons, or every other week, whichever came first. When the full drum was picked up, another drum was left at the restaurant.

The residential WVO jugs were placed in the storage bins, which were located at seven community centers in Gadsden. While other cities have chosen to place the collection bins at grocery stores, Gadsden chose to use its network of community centers. The bins are configured so that empty, clean containers are placed on the top shelf, while full containers are placed on the bottom shelf. Also, the bins are designed so that larger containers of WVO (such as those two-gallon containers used for turkey frying, etc.) can be placed on the bottom shelf.

Once the oil is picked up and transported to the fleet management facility, it is poured (in the case of the one-gallon jugs) or pumped (in the case of the 55-gallon drums) into the chemical storage totes. If water is detected in the WVO, the oil is heated and allowed to cool to separate the water from the oil. Because there are several 275-gallon totes, a rotating procedure is used where the oil is allowed to settle for nearly one week before being used for biodiesel production. The WVO is pumped from the top portion of the tank through a filter and into the biodiesel processor.

After the oil is pumped into the biodiesel processor, minimal labor is required by the fleet management personnel to perform the process. The processor used by Gadsden is a relatively self-sufficient processor that will conduct most of the process automatically. Before starting the transesterification reaction, the WVO is heated to 140 degrees and a sample of oil is removed for the titration procedure, in order to determine how much catalyst is required for biodiesel production. After the titration process is complete, methanol is added to a separate methanol tank and the catalyst is poured into a methyl/oxide mixer drum. After starting the reaction process, it will take approximately one and a half hours for glycerin to begin separating from the biodiesel and another one and a half to two hours for the glycerin to be completely separated.

The system uses a dry wash process that requires an additional three hours to complete. After being allowed to cool, the finished biodiesel can be filtered through a five micron filter, and pumped into the fuel storage tank. Biodiesel is splash blended with petroleum-based diesel to create blends of B10 or B20 for various fleet vehicles or machines.

Glycerin that results from the process is drained from the reactor vessel into a clean 55-gallon drum for later disposal. Disposal options have included composting and transferring to a nearby business that manufactures soaps.

Best Practices of Biodiesel Production: Program Results

Reference Number: MTAS-1487

During the first year of Gadsden's operation, approximately 2,000 gallons of biodiesel have been successfully produced. The fleet manager reported that much more fuel could be produced (as much as one 55-gallon batch each day) if more WVO was available in the community. The fleet manager indicated that the collection and processing operations do not place any undue burden on fleet personnel.

Of the 2,000 gallons of WVO collected, approximately 80 percent was from restaurants and other food industries while 20 percent was from residential sources. Approximately 10 restaurants participated during this period, and most of these were either new businesses or relatively small businesses that did not have existing contracts with WVO processors. The residential program has been successful; however, the fleet manager reports that there is a continuing need to educate the public on the opportunity to recycle WVO. The mayor and fleet manager both gave presentations to civic groups and took the one-gallon jugs with them to pass out to citizens. Also, local news media have been very willing to mention the program. The fleet manager reports that any mention of the program in the media results in an increase in oil collected at the community center bins.

The city does not conduct a formal fuel testing program on its fleet, but has had no vehicle maintenance problems since initiating the program. It does conduct periodic fuel tank cleaning to prevent algae growth. Also, it will conduct the 3/27 test periodically to determine if there is any unreacted WVO in the biodiesel. The only problem reported was with excess water in the WVO. This appears to have been the result of leaving the tops off of the 55-gallon drums while at the restaurants. Heating the WVO has been a successful method of removing water from the oil.

Handling the glycerin by-product has also been successful. While initial phases of the program composted the glycerin, the city has now developed a relationship with a nearby company that produces industrial soaps. This business comes to the fleet maintenance facility and picks up the glycerin for further processing, thereby alleviating the need to dispose of the glycerin.

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