UBC BIODIESEL PROJECT

BIODIESEL PRODUCTION

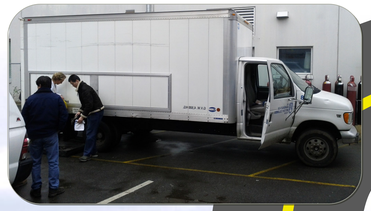
Used cooking oil can be converted to biodiesel, an environmentally friendly alternative fuel that can be used directly in most diesel engines.

The process begins with filtration of the oil to remove dirt and food particles.

If free fatty acid content is too high, the oil is pre-treated to convert the FFAs into fuel.

After pre-treatment, the oil is mixed methanol and a base catalyst producing biodiesel (methyl-esters) and glycerin through a transesterification reaction.

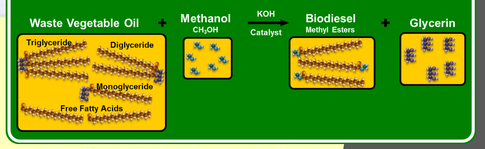
Excess methanol is boiled off and recovered, the glycerin is separated and the KOH washed out, leaving biodiesel fuel, which is blended with petro-diesel and sold.



ION EXCHANGE

An ion exchange column was added to the back end of the system for dry washing of the biodiesel. The ion exchange beads remove excess KOH, methanol and trace glycerol, producing pure biodiesel and eliminating the need for lengthy water washing.

TRANSESTERIFICATION



RAW MATERIALS

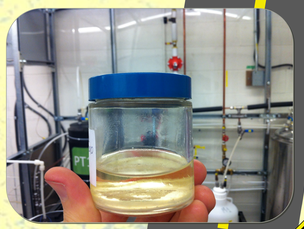
Waste oil is obtained from UBC Food Services fryers. The oil is otherwise collected for incineration.

Methanol comes from UBC Solvent Recovery, recovered from waste lab solvent. Excess methanol fro biodiesel production is returned to solvent recovery for distillation and re-use.

Clean vegetable oil is also used and is donated as freight damaged oil, unfit for human consumption.

PRODUCTION FACILITY

In 2008 the biodiesel project was resurrected and a new production plant constructed, in space previously set aside by Prof. Naoko Ellis, in the Chemical and Biological Engineering Building. Biodiesel is produced in 60-70L batches in an electrically heated reactor at atmospheric pressure and ~62°C. The plant has a separate pre-treatment reactor where esterification pre-treatment is preformed if necessary. After the reaction, excess methanol is removed via a vacuum pump.

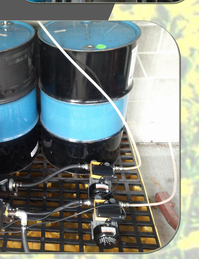


QUALITY

A high fuel quality is crucial for ensuring problem-free use of biodiesel. ASTM D6751 defines the biodiesel standard. In-house testing of the biodiesel for water, methanol and glycerol content is conducted using a Gas Chromatograph. The cloud point of the fuel is also tested in-house. Recent testing has shown a cloud point of -1.5°C, less than 0.01 %volume water, and less than 0.01 %volume glycerin.

PUMPING STATION

Two engineering physics students, designed and constructed a micro-processor controlled blend-on-demand fuelling station, as part of their 4th year project lab. The station stores 200L of biodiesel and petro-diesel and allows for accurate blending of the two fuels. Blend-on-demand allows the user to select any desired grade of biodiesel blend from B5 to B100. The system also produces receipts that show the buyer their CO_2 emission reductions.



FUEL SALES

To date he biodiesel project has sold 800L of blended fuel, 180 L of which was biodiesel produced by project volunteers. This amounts to 363 kg of CO_2 offset. The primary consumer / supporter of the project is UBC Housing and Hospitality Services.

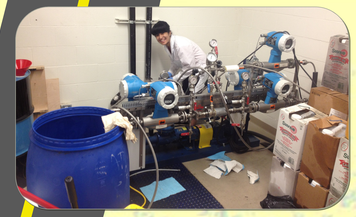
800 L

SOAP PRODUCTION

To eliminate waste from the biodiesel production, soap is produced from the glycerin by-product, through saponification of the glycerin with water and KOH (liquid soap) and NaOH (solid soap). Liquid soap produced is used in laboratories throughout the building.

HYDROCYCLONE SEPARATION

A hydrocyclone separates liquids of different densities through the use of centrifugal force. Experiments are in progress to determine the effectiveness of such a device at removing glycerin from the biodiesel fuel. A test rig on loan from Natural Resources Canada is being used for this purpose. If the tests are successful the hydrocyclone could be incorporated into the production process, eliminating the time for glycerin settling.



THE BIODIESEL TEAM

The biodiesel project is run by volunteers from the CHBE Sustainability Club. The team consists of a few supervising graduate students and a large number of enthusiastic undergraduates, eager to put their engineering skills to use in a practical setting. The project has provided summer employment for a number of undergraduate students as well. Prof. Naoko Ellis is the supervision faculty member for the project, donating lab space and time to keep the project going. Special Thanks to our sponsors listed below and project partner, UBC Housing and Hospitality Services.

AMS SUSTAINABILITY

impact!

UBC Professional Activities Fund

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