BIO-DIESEL

Going green can have multiple benefits.

BY MORRIS JOHNSON

In 2005, River Oaks Country Club in Houston, Texas, began to refocus its efforts on making the club greener and reducing its environmental footprint. A retrofit of the club's lighting system yielded favorable results, and a major clubhouse renovation that year included the implementation of many energy-saving systems. In 2008, the club began an encompassing recycling program in all departments, and that same year, Joe Bendy, general manager, requested the golf course operations department to research the possibility of converting the club's used cooking oil into bio-diesel fuel. For years, the club had paid to have the waste oil removed, and with some companies paying for used oil, it was determined that an even better solution would be to convert the used oil to bio-diesel.

After considerable research we soon realized that few clubs in Texas were making bio-diesel — yet the process seemed fairly simple. After speaking to various companies about the equipment and process, we selected Evolution Bio-diesel in Huntsville, Texas. They make conversion machines in different sizes and are very user friendly. The last thing we wanted was a complicated and time-consuming process that taxed our already busy maintenance department. Having done considerable research on the process, our equipment manager, Gavin Williams, undertook the project with enthusiasm.

As with any new endeavor, effective and thorough training is one of the major keys to success, and having that training take place on-site was important to us. Evolution Bio-diesel conducted the training and orientation with our equipment on-site, which we felt was better than training at a different facility. The on-site training also allowed Evolution to monitor the process and comment on our equipment setup, handling of product, production process, storage, and ultimately the bio-diesel use. We soon learned that turning regular cooking oil into bio-diesel can be done by any club at any budget level. Bio-diesel can be made on a small scale using five-gallon drums or an 80-gallon processor on a medium scale, like the one used at River Oaks Country Club.

The used cooking oil storage tank is located at the clubhouse. A pallet tank works well in this instance.

Whatever the scale chosen, the final product will be consistent by following this simple process.

STEP ONE

Oil collection and storage. Waste vegetable oil, which is normally soybean, canola, cottonseed, and palm oil, can be used. Store the oil as you would any fuel in a closed container, avoiding any water contamination.

STEP TWO

Filtering the oil. It is critical to have the least amount of contaminants in the final product and processing machine as possible. No one wants to find a piece of chicken in a fuel filter. With our 80-gallon processor, the filtering occurs when the waste oil is poured through a 300- and a 400-micron filter into a 55-gallon drum. The filtered waste oil is then pumped into the processor.

STEP THREE

Heating the waste oil. The processor is equipped with an inline heating system to heat the oil to an operating temperature of 140 degrees. This also dries the oil so that any moisture in the oil is removed.

STEP FOUR

Titration. The titration functions as a pH test and is a way to find out how much potassium hydroxide (KOH) and catalyst is needed for the transesterification process (mixing a sodium hydroxide solution and a sample of the oil with alcohol and phenolphalein). This process helps calculate how much catalyst is needed for processing oil into bio-diesel. If virgin oil is used (unused oil), then a base amount catalyst is used (5 grams/liter).

STEP FIVE

Proper mixing of the methanol and KOH. After calculating the titration results, the methanol and KOH are mixed together to form methoxide. Accurate titration results are necessary to avoid unconverted oil and bio-diesel in the reactor tank. The finished oil product will be just 20% of the original oil volume.

The bio-diesel processor and straining units are housed within a spill containment area. The pallet tank to the right is used for dispensing the final fuel product.

Gavin Williams (left), equipment manager, and Morris Johnson, golf course superintendent, River Oaks Country Club, Houston, Texas, with their bio-diesel processing system.

STEP SIX

Removing the glycerin. The transesterification process yields two products: bio-diesel and glycerin/free fatty acids. Once the heated oil and methoxide are mixed for about 90 minutes, the batch is left to settle out the glycerin. This process can take four to eight hours (same as step five).

STEP SEVEN

Water washing. After the transesterification process, the bio-diesel is in a raw form and contains contaminants such as the catalyst, soaps, and free glycerin. Water washing removes these contaminants.

STEP EIGHT

Drying the final product. The next step is to settle, drain, and run the bio-diesel through the inline heater. The heater removes any water left in the fuel. After the four- to six-hour heating process, the bio-diesel is ready to be used in any diesel engine. The final product is transferred into an equipment fuel storage tank.

REUSE AND SAVE

Bio-diesel is not only a great way to reuse waste oil, but it also saves the club thousands of dollars in fuel expense. In 2009, River Oaks Country Club produced 1700 gallons of bio-diesel at a cost of under $650. Excluding labor, the cost to produce the bio-diesel in 2009 averaged $0.38 to $0.40 cents per gallon. All of the original costs were recovered in less than 18 months. Bio-diesel can also be used in shop heaters, eliminating the extra carbon dioxide emissions that regular heaters and diesel engines produce. Bio-diesel also provides a 90% reduction in unburned hydrocarbons, contains no sulfur, and helps lubricate and prolong engine life. Using bio-diesel has not, in our experience, caused any issues with manufacturer warranties.

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