2008 TAIWAN INTERNATIONAL SCIENCE FAIR

CATEGORY : Environmental Science

PROJECT : Biodiesel:does it make cents?

AWARDS : Environmental Science Third Award

SCHOOL : Dr. Kearney Junior Secondary School

FINALISTS : Kimberly Gulevich

COUNTRY : Canada

ABSTRACT OF EXHIBIT
TAIWAN INTERNATIONAL SCIENCE FAIR

CATEGORY: (XII) Environmental Science
TITLE: Biodiesel: Does it Make Cents?
NAME: Kimberly Gulevich
COUNTRY: Canada

My project explores the practicality of biodiesel. It researches the argument of food versus fuel, compares the energy efficiencies of petroleum diesel and biodiesel and studies the effect of temperature on biodiesel.

To study the effect of temperature on biodiesel, I blended biodiesel with petroleum diesel. Biodiesel blends are represented by the letter B, and the percentage of biodiesel. I used B5, B10, B20, and B50 blends, as well as pure biodiesel. I then observed the reaction of the biodiesel blends with cold weather. My pure biodiesel and B50 blends gelled to an unusable point within 15 minutes outside at -20°C. The B20 blends didn't gel until about a temperature of -20°C. I have concluded that the B20 blend would be best for the summer, and the B10 or B5 blends would be the best for winter in northern climates, where I live. Although the B10 blends gelled slightly around -30°C, this would only be a problem for northern climates.

As I predicted, more energy is produced by biodiesel than is consumed in the production process. The process of making biodiesel uses 0.31 units of energy to get 1 unit of energy out. More energy (1.2 units) is used to produce petroleum diesel than is yielded (1 unit). Although B20 isn't as energy efficient as B100, the energy factor is still only 0.98 units of energy in for every 1 unit of energy out.

When I started this project I thought that Canada would have enough farmland to produce the canola needed to run the country on biodiesel. This is only partly true. Canada would have enough farmland, but only a fraction of that land is actually used to plant canola. By my calculations, Canada has enough canola to generate enough B20 for a year. This may seem like a drawback but realistically, a higher blend would be impractical due to the gelling factor. Also, if a B20 blend was used, land would be available to grow canola for other markets. If B100 was used, there would only be enough diesel for about three months consumption.

By using all of the land for biodiesel feedstock, canola would become unavailable for other markets. If canola exports ceased, the countries that depend on our canola will be in a lot of trouble.

Canada already produces a lot of canola and vegetable oil. Most of it goes to the fast food industry. The United States produces over three billion gallons of fryer oil yearly. This could provide Canada with a B50 blend for a year. Utilizing used vegetable oil in making biodiesel actually reduces emissions even more. This is accomplished by using a product that would normally go to waste and decompose, producing more carbon dioxide emissions.

During this project, I have found that biodiesel is a practical alternative to petroleum diesel, if it is used in a blend. My experiment proves that biodiesel is a fuel alternative that could be implemented immediately, and one that does not require the research needed for other fuel alternatives such as hydrogen or electricity.

評語

本計畫係以 Canola 爲原料研究作爲生質柴油之可行性，由其研究發現生質柴油之最佳調配比例和其對低溫之敏感度。本研究對再生能源之開發頗有參考價值。