111e Transesterification Reaction Parameters Optimization for the Production of Ethyl Ester Using Waste Cooking Oil and Ethanol

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Biodiesel as a renewable fuel source provides several advantages over petroleum diesel. It is non toxic and biodegradable. It also reduces exhaust emissions of carbon monoxide (CO), unburned hydrocarbons (UHC), particulate matter (PM), and sulfur dioxide (SO2). Its use can improve the air quality, create jobs, and help reduce the dependency on limited resources and imports. Biodiesel can be produced from animal fats and oils which are typically water-insoluble substances known as triglycerides. The majority of biodiesel is produced today through the base catalyzed transesterification reaction because it involves low temperature and pressure processing, high conversions, no intermediate steps, and lower costs of processing materials. Sodium hydroxide as base catalyst and methanol as alcohol are commonly used for the transesterification reaction. However, methanol is a highly toxic solvent. It does not produce a visible flame when burning, and has a lower flash point and a lower boiling point. On the other hand, ethanol is easy to handle and renewable that can be produced from biomass. Thus, the use of ethanol over methanol is a clear choice from both a safety and an environmental standpoint.

Based on the current literature, it is apparent that the future of biodiesel as a low cost alternative to petroleum fuel can result from a proper understanding of the production process using renewable and low cost feedstock such as waste cooking oil. Our long-term goal is to recycle waste coking oil from University of Nevada dining commons and convert it to biodiesel for a diesel-free campus using a continuous production pilot unit, which will be set up through this project. Extensive work has been done on the kinetic and optimization of biodiesel reaction with virgin oils and methanol. However, the information that is available in literature for the reaction kinetics that use ethanol and waste cooking oil is insufficient. Therefore, we started by studying the kinetics of the biodiesel reaction using waste cooking oil and ethanol. This presentation will discuss the modified analytical methods and the effect of ethanol concentration, catalyst amount, and reaction temperature on the biodiesel yield.