111b Production of Biodiesel Using an Integrated Extraction/Reaction Process

Rafael Hernandez, Mark Zappi, Todd French, Jaricus Whitlock, and Earl Alley

In the United States, most of the vegetable oil-based biodiesel is generated using soybean oil extracted with hexane. Biodiesel is produced via base catalyzed transesterification of the soybean oil. The model of oil extraction followed by transesterification is based on the edible oils and animal feeds production process. Presently, biodiesel as an alternative fuel is not economically feasible. Some of the causes for the high cost of biodiesel include high feedstock cost and implementation of traditional production processes, which are operationally inefficient. A process and feedstocks developed specifically for biodiesel production would make the cost of the fuel more price competitive. One alternative is the integration of extraction and transesterification. The process would involve the use of methanol or ethanol as the extraction solvent. The catalyst (base) would be mixed with the alcohol and the feedstock during the extraction process producing the alkyl esters *in-situ*. The alkyl ester mixture would be filtered or centrifuged and the unreacted alcohol recovered and recycled via distillation. This paper will discuss determination of the fundamental reaction design parameters of the *in-situ* alkaline transesterification process for biodiesel production. Experimental results will be presented on the effect of particle size (surface area), temperature, solvent concentration, reactor residence time, moisture content, and mixing on the oil conversion, biodiesel yield, and selectivity. An Accelerated Solvent Extractor manufactured by Dionex and a Parr reactor were used to determined reaction rate expressions, activation energy, and frequency and efficiency factors.