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Development of supercritical transesterification for sustainable conversion of oils to biodiesel

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A continuous biodiesel production process at supercritical conditions is under development for conversion of oils to biodiesel that will power USF's bus system. The process will be solar energy driven and mobile with a weekly capacity of 400 gallons of B100-grade biodiesel. The raw material, used cooking oil, will be sourced from dining operations throughout the campus. Unlike conventional biodiesel production, the process is performed at supercritical conditions that do not require the use of a catalyst. This eliminates the need for a catalyst separation step and also enhances sustainability by saving on the large amounts of water required for biodiesel washing. Supercritical transesterification is capable of producing biodiesel an order of magnitude faster compared to conventional transesterification, thus reducing operating costs and boosting productivity. The process is tolerant to the presence of water and free fatty acids in used cooking oil expanding the range of suitable low-cost feedstocks for biodiesel production. Heat integration between the hot products and cold reactants reduces energy costs. Glycerol, the byproduct, is relatively pure and can be used for production of high quality soap or high-value pharmaceutical applications. We present our investigation of the effects of reaction temperature, reaction pressure, and residence time on biodiesel production kinetics and yield. Gas chromatography-mass spectrometry (GC-MS) was used for determining the product composition.

Biography

Shriyash Deshpande is a recent graduate with a Master's degree in Chemical Engineering from the University of South Florida. His master's thesis entitled "Production of Biodiesel from Soybean Oil Using Supercritical Methanol" covered the depths of supercritical transesterification, reaction kinetics, gas chromatography for biodiesel analysis and design of experiments with statistical analysis. He is currently working on scaling up to a pilot plant for biodiesel production using supercritical fluid technology.

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