

PROJECT FACTS

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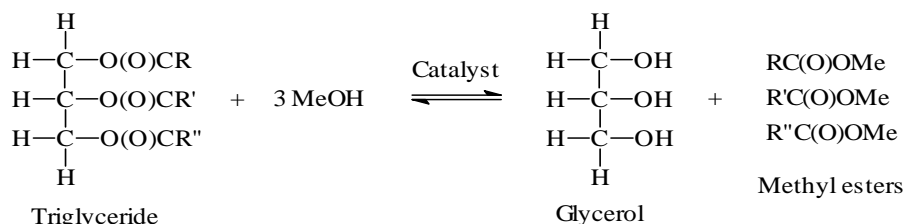


BIOFUELS & ENVIRONMENTAL CATALYSIS

Development of Heterogeneous Catalysts for Improved Biodiesel Production

Supplementing petroleum consumption with renewable biomass resources is a first step to securing a petroleum-independent future. One immediate solution for reducing petroleum consumption is the use of ethanol and biodiesel blends as transportation fuels. Biodiesel is a fuel composed of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats and meeting the requirements of the ASTM (American Society for Testing & Materials) D 6751 standard. Pure biodiesel, referred to as B100, can be blended with petroleum diesel in any ratio, such that a 20% biodiesel blend is referred to as B20.

Commercially, biodiesel is produced from edible vegetable oils, including rapeseed, sunflower and soybean oil. These oils are typically composed of C₁₄-C₂₀ fatty acid triglycerides (constituting ~90-95% of the oil by weight). In order to produce a fuel that is suitable for use in diesel engines, these triglycerides are converted to the respective alkyl esters and glycerol by base-catalyzed transesterification with short chain alcohols (methanol or ethanol):



Typically, KOH or NaOH is used as the catalyst (dissolved in the appropriate alcohol). While the conversion of vegetable oil to biodiesel is fairly straightforward, downstream processing steps are required in order for the product to meet fuel standards. Specifically, during the transesterification process and product work-up, soaps and other salts are formed, which must be removed from both the product biodiesel stream and the co-product glycerol stream. Purification of the glycerol in particular involves a number of steps in order to afford a product with 99+% purity, which can be sold into the cosmetic and pharmaceutical industries.

In order to circumvent these problems, the use of heterogeneous catalysts is attractive. This approach largely eliminates the formation of metal salts, thereby simplifying downstream separation steps and affording, in principle, a purer glycerol product. In this project we are examining the potential of a number of solid-base catalysts, such as mixed metal oxides, for the transesterification of soybean oil with methanol. In order to optimize biodiesel production, the effect of relevant process parameters (temperature, residence time, methanol:soybean oil ratio, etc.) on the biodiesel production rate is also being studied.