A Continuous Catalytic System for Biodiesel Production

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Abstract
A novel continuous fixed bed reactor process has been developed for the production of biodiesel using a metal oxide-based catalyst. Porous zirconia, titania and alumina micro-particulate heterogeneous catalysts are shown to be capable of continuous rapid esterification and transesterfication reactions under high pressure (ca. 2500 psi) and elevated temperature (300–450 °C). The continuous transesterification of triglycerides and simultaneous esterification of free fatty acids with residence times as low as 5.4 s is described. Biodiesel produced from soybean oil, acidulated soapstock, tall oil, algae oil, and corn oil with different alcohols to make different alkyl esters using this new process pass all current ASTM testing specifications. Furthermore, the economics of this novel process is much more cost competitive due to the use of inexpensive lipid feedstocks that often contain high levels of free fatty acids. The process has been shown to easily scale up a factor of 49 for more than 115 h of continuous operation without loss of conversion efficiency. The increased use of biodiesel world-wide could help reduce the emission of greenhouse gases that are linked to the progression of global warming.