The role of heterogeneous catalysis in the mitigation of biodiesel waste

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Abstract:

Fossil fuels including oil, coal and gas, account for nearly 82% of the total 13,000 million tonnes (oil equivalent) of fuel consumed annually. With a steadily growing global population, the demand for energy has increased further and consequently, the quantity of carbon pollution (in particular, carbon dioxide) attributable to the burning of fossil fuels has steadily increased with it. Biodiesel is an increasingly viable alternative to diesel fuel and carbon dioxide released through burning it is offset by the uptake of CO_2 by the plants from which it is produced. Roughly 10 wt% of the final product however, is made up of glycerol, the production of which is presently excessive to demand, rendering research and development into sustainable uses for the chemical pertinent.

Value-added chemicals derivable from glycerol are numerous, however glycidol (2,3-epoxy-1-propanol) represents a particularly attractive product for its range of potential applications and versatile chemistry. Glycidol is prepared by first obtaining allyl alcohol from glycerol. This may be achieved by heating glycerol to produce acrolein, which is then selectively reduced. More preferable though, would be direct conversion to allyl alcohol and this has been achieved using transition metal oxides supported on alumina as catalysts. The selective epoxidation of allyl alcohol may then be achieved using peroxides and a variety of transition metal catalysts, most notably titanium-substituted zeolites such as titanium silicalite-1 (TS1).

This work focuses on the production of glycidol from genuine waste glycerol sourced from biodiesel manufacture and methods of enhancing product yield.

Biographical Statement of speaker:

Luke Harvey obtained bachelor's degrees in Science (Chemistry) and Engineering (Chemical) at the University of Newcastle in 2013. Since then he has undertaken PhD studies under Professors Stockenhuber and Kennedy, focussing on the catalytic partial oxidation of chemicals derived from waste glycerol generated in biodiesel production.