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Funding Source: College of Engineering Undergraduate Research Option

Producing practical uses for biodiesel byproducts through the conversion of glycerol

Josh Ronco & Galen Suppes

With biofuels such as biodiesel and ethanol becoming increasingly popular alternatives to fossil fuels in our society, the question becomes one of economics. The production technologies are quickly becoming available, but how can biofuels be efficiently and cleanly produced with limited waste? This is a question this research aims to answer; by finding methods of converting glycerol, the waste byproduct of biodiesel production, into chemicals that benefit society and no longer make biodiesel a cost prohibitive option. Glycerol is a simple 3-carbon chain molecule bearing a hydroxyl group on each carbon atom. The reaction to produce biodiesel yields a minimum of 10% glycerol by mass, which has flooded the world market and will continue to due so in the future in both Europe and the United States. Through various dehydration, hydrogenation, and oxidation reaction mechanisms, this research is working on ways to turn this surplus of waste product into valuable chemicals such as propylene glycol, acrylic acid, and other platform chemicals to be used by many different industries. The research focuses on catalytic processes with high yields and selectivities towards high value products and low selectivities towards toxic byproducts such as ethylene glycol. From a chemical engineering perspective, operating conditions are another key aspect of finding an industrial viable process. We focus on operating conditions below 300°C and relatively low pressures Turning a waste byproduct into a valuable product means a benefit to consumers on both ends; biodiesel is made more affordable, and products such as non-toxic antifreeze and health and cosmetic products become more affordable and available.