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EXTENDING THE LIFE OF PETROLEUM RESOURCES: CASE STUDIES ON CHEMICALS FROM GLYCEROL

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In the search for sustainable alternatives to petro-based transportation fuels, biodiesel has attracted a lot of attention. The economics of biodiesel production is significantly impacted by the market for its by-product, glycerol. Glycerol in its own right presents interesting possibilities for replacement of petrochemicals and has been viewed as a versatile building block chemical because of its multifunctionality. However, its availability and price in the market are tied to the fortunes of biodiesel, and hence, one should probably target high value products from it. In this talk, we present a few possibilities of this type. Oxidative valorisation of glycerol can lead to products like dihydroxyacetone and tartronic acid which have a high market value. However, directing the oxidation is a challenging task. Several catalysts have been investigated in this regard and Pt, Pd, Au and Bi have shown potential. The activity and selectivity of these catalysts are highly dependent on the support, and support interactions have to be understood in order to realise process possibilities. The choice of reactors presents another challenge because of the complex chemistry of the oxidation, as well as the possibility of mass transfer influences. A systematic study of kinetics accounting for all these factors can point to the right direction in terms of reactor selection. Here we present results from a detailed kinetic investigation on Pd-catalysed glycerol oxidation, and some conclusions on choice of reactor. Hydrogenolysis of glycerol can lead to 1, 2- propanediols and 1, 3-propanediols. While both present possibilities to replace petro-based monomers, 1, 3-PD is particularly attractive as a replacement of ethylene glycol in polyester manufacture. Here again, it is a challenge to direct the reaction to the desired product. While noble metal catalysts supported on tungsten oxide or silico-tungstic acid has shown potential, the literature is often inconclusive about the mechanism of the reaction involved. We present a review and some of our own results on this reaction in this talk.

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