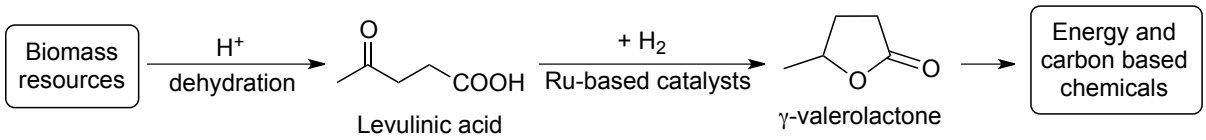
Homogeneous catalysis in biomass conversion

László T. Mika
Associate Professor
Department of Chemical and Environmental Process Engineering
Budapest University of Technology and Economics, e-mail: laszlo.t.mika@mail.bme.hu

The replacement of fossil resources, which provide more than 95 % of our energy needs and feedstock of chemical industry is one of the most challenging tasks of our generation. Accordingly, the production of carbon-based chemicals from sustainable resources has become a key issue for the chemical technology. The intensive research activities on biomass conversion has led to the identification of unique platform molecules such as 5-hydroxymethyl furfural,[1] and its key derivatives levulinic acid (LA) and derivatives γ-valerolactone (GVL).[2] These small molecules could replace the currently used fossil-based chemicals or serve as renewable feedstock for their production.

The selective conversion of non-edible components of biomass, such as cellulose or chitin could provide an alternative route for the production of these platform chemicals. Since the most efficient route to manufacture GVL is the hydrogenation of LA, the development of selective catalyst is another crucial point of the efficient biomass conversion. It was established that fructose, glucose, cellulose, and chitin can be converted to LA in the presence of sulfuric acid using either conventional or microwave dielectric heating with yield of 20 – 40 wt%.[3] We have developed different recyclable Ru-based catalyst systems[4] that can quantitatively reduce LA to GVL under solvent and any additive free, "green" conditions achieving turnover number over 21000 h^{-1}.



The catalyst design and development for biomass conversion producing LA and GVL from verious resources will be presented. The selected application of GVL *e.g.* alternative solvent for catalysis[5] and the syntesis of optically active GVL as a chiral renewable building block will be discussed as well.

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