Biomass for Production of Fuels and Chemicals: The C-factor

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Biomass is a limited resource, and thus it should be carefully considered how it is used optimally. If we, in simple and relative terms, look at the value of various raw materials and some major products in the fossil economy, i.e. the chemical industry today, it is clear that transportation fuels are among the least expensive products that are derived from the fossil resources. This can be illustrated by a fossil value chain. If we instead envisage that the same products (fuels and chemicals) should be produced from biomass, then another renewable value chain materializes. Obviously, these value chains are initially only qualitative evaluations because the cost of the feedstock can vary dramatically from region to region and also because the efficiency of the involved catalytic and biocatalytic processes is continually improved. Anyhow, it is clear that it appears very attractive to attempt to convert biomass into high value-added products rather than into relatively low-value fuels in order to maximize profit margins. Here, the opportunities for using biomass as a feedstock for the chemical industry are considered in more detail, and some recent developments employing heterogeneous gold catalysts are highlighted. In particular, it is shown how a simple approach based on the above fossil and renewable value-chains combined with the concept of C-factors can help identify suitable targets for such a development effort.

The C-factor expresses the amount of CO_2 produced per amount of product, and thereby measures the potential impact on climate of a given process. Interestingly, the conversion of biomass into chemicals can in some cases lead to significantly higher reductions in carbon dioxide levels than what is possible by converting it into fuels. This is so because transformation of biomass (carbohydrates) into chemicals is a fundamentally different challenge than converting fossil fuels (hydrocarbons) into chemicals. Several examples are given to illustrate this approach, with a special emphasis on the opportunities for producing major petrochemicals from renewable resources.