

## Biorefineries: The Central Role of Catalysis

Thursday 10 March 2016 09:45 (45 minutes)

The development and implementation of biorefinery processes is of the utmost importance to meet the vision towards a sustainable economy based on bio-resources [1,2]. In this context, catalysis, either enzymatic, heterogeneous or homogeneous is playing a major role like this is already the case in a 'conventional' refinery based on the treatment and the conversion of petro-resources. Nevertheless, contrary to petro-resources of which the nature and composition variations are 'relatively' limited, under the term 'bio-resource' or 'biomass' are gathered compounds of very different natures, namely cellulose, hemicellulose, oils, lignin and so on... Thus, a complete set of specific technologies must be developed in order to convert each fraction as smartly as possible. This implies, among others, the elaboration of a lot of processes based on catalysis. These latter constitute core technologies that will be implemented in the so-called 'biorefineries'. Within this frame, the present author coordinated the elaboration and the development of the EuroBioRef concept 'EUROpean multilevel integrated BIOREFinery design for sustainable biomass processing' ([www.eurobioref.org](http://www.eurobioref.org)), as a 'large-scale' European project (2010-2014). EuroBioRef is a new highly integrated, diversified and sustainable concept, which involves all the biomass sector stakeholders. The potential of all the fractions issued from the various types of biomass is used to yield a value-added as high as possible in a sustainable and economical way. The overall efficiency of this approach is a vast improvement to the existing situation and considers options such as: Production and use of a high diversity of sustainable biomass adapted for European regions / Production and use of high specific energy bio-aviation fuels (42 MJ/kg) / Production of multiple products (chemicals, polymers, materials) in a flexible and optimized way that takes advantage of the differences in biomass components and intermediates / Improvement of the cost efficiency by as much as 30 per cent through improved reaction and separation effectiveness, reduced capital investments, improved plant and feedstock flexibility and reduction of production time and logistics / Reduction by 30 per cent of the required energy / Zero waste production and reduction of feedstock consumption.

The EuroBioRef novel concept will be presented, after a general introduction on biomass, biorefineries and catalysis of which the central and key role will be discussed. Then, the next important developments for the next decade concerning catalysis for biorefineries will be presented. First, a new high throughput approach for catalysts developments materialized by the REALCAT platform [3] will be described, and then, the new concept of hybrid catalysis [4-6], integrating in one-pot chemo- and bio-catalysis, taking advantage of both technologies by creating synergies, will be presented.

### References

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- 3) F. Dumeignil, L. Montagne, R. Froidevaux, S. Heyte, S. Paul. Chapitre 9 de 'Modern Applications of High Throughput R&D in Heterogeneous Catalysis', Bentham Science Publishers, Alfred Hagemeyer and Anthony F. Volpe, Jr. (Eds), p324-337 (2014).
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- 5) M. Guehl, S. Desset, D. Delcroix, N. Lopes Ferreira, F. Dumeignil, FR15/50.532 Patent filed by IFPEN-UCCS (2014).
- 6) F. Dumeignil F., Chem. Ing. Tech. 2014, 86(9), 1496.

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