SINCHEM PhD subject

Catalytic upgrading of oxygenated building blocks in lignocellulose-based biorefineries

HOME INSTITUTION: Università di Bologna, Bologna, Italy. Supervisors of the PhD student in Bologna: Prof. Fabrizio Cavani and Dr. Stefania Albonetti

HOST INSTITUTION 1: **LYON 1 university – C2P2 Unit**, **France.**. Supervisors of the PhD student in Lyon: Prof. Alessandra Quadrelli.

HOST INSTITUTION 2: **Messina University (ITALY)**

PROJECT DETAILS

The biorefinery is an important approach for the current needs of energy and chemical building blocks for a wide range of applications, that gradually may replace current dependence on fossil-fuel resources. In this context, furfural and 5-hydroxymethylfurfural (HMF) are considered important Bio-based Building Blocks, potentially available in large quantity starting from monosaccharides. For example, HMF is very useful not only as intermediate for the production of the biofuel components dimethylfuran and dimethyltetrahydrofuran, but also of important molecules such as levulinic acid, 2,5-furandicarboxylic acid and 2,5-diformylfuran. Several catalytic transformations of HMF as a substrate involving formyl and/or hydroxyl groups have been reported in the literature, but still the potential exploitability of this substrate has to be investigated.
As an example, HMF can be oxidized to obtain 2,5-furandicarboxylic acid (FDCA), a monomer for the synthesis of a new class of polymers, alternative to those obtained from terephthalic acid. In fact, the effects of bioaccumulation of phthalates and polymers in living organisms are known since long time. The polymer obtained from FDCA, besides being derived from a bio-derived, renewable raw material, is more easily degradable and does not present problems of bioaccumulation.
The Ph.D student work will be focused on the oxidation and reduction of furfural and HMF using heterogeneous catalysts in liquid and gas phases. New materials will be tested for these reactions using reactor equipment and analytical methods that are available at the Bologna laboratories. A careful characterization before and after the catalytic tests will be performed in collaboration with **LYON University.** In particular, spectroscopic methods will be used for the study of the interaction between catalysts surface and probe molecules.