Catalytic biomass revalorization: 2-furaldehyde oxidation reactions

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Nowadays, an important challenge is the development of integrated biorefineries that includes biomass from agro-industrial waste, such as forest, animal and urban. That means integrate the stages of production of biomass, i.e. production of intermediate goods (chemicals in bulk) and the valuation of these intermediates in search of bio-products of great value, capable of replacing chemical compounds derived from fossil sources. Thus, the main objective of this study is the valorization of platform molecules derived from biomass, such as 2-furaldehyde (Furfural), by a catalytic oxidation process using H_2O_2 as oxidant. In this sense, the use of heterogeneous catalysts such as: (1) microporous and hierarchical porosity materials modified with transition metals, and (2) organometallics complexes supported on zeolites, will be the key in order to improve selectivity to desire products and to optimize reaction parameters. The goal is to obtain derivatives of great value through sustainable processes, especially Succinic acid. This compound is between the 10 most important biomass derivatives since it is a precursor of industrially important chemicals such as 1,4-butanediol, tetrahydrofurane, γ-butyrolactone and pyrrolidinone.

Oxidation reactions were done at different hydrogen peroxide concentrations, temperatures and reaction medium (in presence or absence of NaOH). Samples were withdrawn at different reaction times until 60 minutes and analysed by HPLC equipped with IR and UV detectors, after filtering in order to separate the solid catalyst. Blank reaction -without catalyst- showed low conversion values in the order of 40 mol % and low selectivity to succinic and furoic acids. However, when cooper impregnated zeolites Y and ZSM-5 were employed as solid catalysts, furfural conversion higher than 90% were obtained at 70°C. Maleic acid, succinic acid and fuoric acid were producted when transitions metals (Cu, Fe and Ni) and nobel metals (Pd and Pt) modified zeolites were employed as catalysts. The presence of sodium hydroxide in the reaction medium favoured the succinic acid formation. Besides this, acetic acid presence as an undesirable product was not detected in these reactions.