Reductive amination of alcohols and ketones from Biomass feedstocks. A catalytic green route for synthesis of primary amines and Amino Acids

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Abstract

Amino acids (AA) are the basic building blocks of protein synthesis and for this reason are widely used in the field of biological, pharmaceutical, food and industrial medical intermediates. Currently the production of AA is mainly obtained via biocultivation process and by the way of chemical methods. In both cases, the severe operation conditions and complicated separation procedures show some restrictions on industrial application. Therefore, developing new process for efficient amino acid production via a green and clean way is of significance but still an open challenge.

The purpose of this study is to describe the synthesis of amino-compounds from Biomass-derived chemicals, specifically compounds containing oxygen groups which can be used as a renewable feedstock. The reductive amination of compounds from biomass-derivative substrates with NH_3 is a process that meets with the demand of economical and greener processes in AA production through reductive amination.

For this purpose, Rh/SiO_2 and bimetallic $Rh\text{-}Ni/SiO_2$ catalysts were synthesized. Catalysts were characterized by N_2 sorption, Chemisorption, XPS, SEM, TEM, NH_3-TPD and TPR-H_2. The catalytic reactions were carried out at 373 K, 4 bar of NH_3, 2 bar of H_2, using a substrate/Rh mol ratio=100 at 800 rpm in 50 mL of cyclohexane. Products of reaction were analyzed by GC-MS. The catalysts were active and selective in hydrogenation and amination reactions. The conversion to amines can be affected by factors such as metallic diameter, nature and amount of metal sites, metal dispersion, metal reduction ratio, among others. Specifically, in this study, better results are obtained for reductive amination of ketones in catalysts that present high hydrogenating capacity and high acidity. Conversion of ketones involves amination and hydrogenation steps to produce high conversion and maximum selectivity (100%) to primary amines. One of the AA studied, lactic acid, showed conversion to alanine by successive dehydrogenation-amination-hydrogenation pathways of reaction.

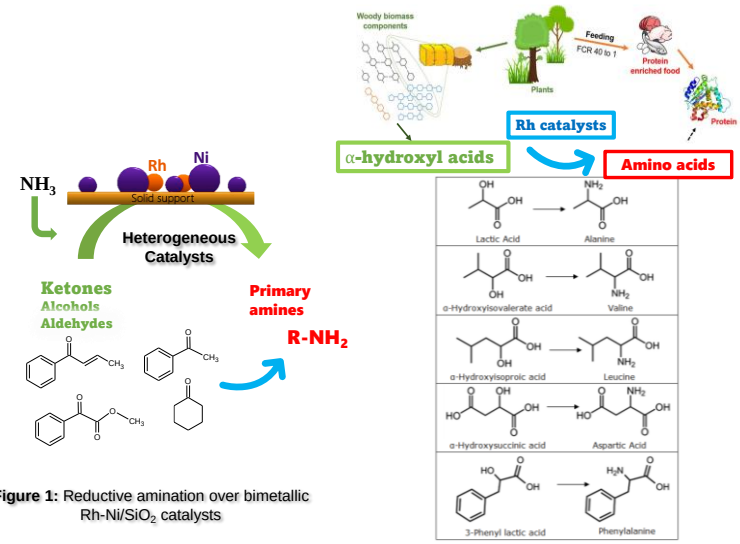


Figure 1: Reductive amination over bimetallic Rh-Ni/SiO_2 catalysts

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Photograph



Biography

Doris Ruiz is currently Associate Professor in Physical Chemistry at the University of Concepcion, in Concepción, Chile (http://www2.udec.cl/cienciasquimicas/). She has her expertise in Heterogeneous Catalysis, specifically focused on: Enantioselective Catalysis, Hydrogenation and Amination reactions, valorization of compounds from Biomass feedstocks, Green Chemistry, Fine Chemistry and Nanomaterials. She leads the "Laboratory of Heterogeneous Catalysis for Valorization and Selective Chemical Processes". She currently focuses her research on the catalytic synthesis of amino acids from α-hydroxy acids obtained from biomass feedstocks over supported bimetallic catalysts.

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