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Entitle

UPGRADING BIOMASS TO BIO-OIL: CATALYTIC HYDRODEOXYGENATION AND PYROLYSIS OF VANILLIN AND ANISOLE BIOMASS MODEL COMPOUNDS

By

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Abstract

The purpose of this project is to investigate capacity of selected formulations of catalysts toward the hydrodeoxygenation (HDO) of biomass model compounds in the gas phase with the underlying aim to produce hydrocarbon cuts that can be directly used as transportation fuels. The first part of this project is to devoted to illustrate procedures for the synthesis of potent (HDO catalysts. Synthesized catalysts encompass nickel (Ni), cobalt (Co) and palladium (Pd) supported on zeolite, cerium oxide (CeO_2) or alumina (Al_2O_3). Various characterization techniques such as X-ray Diffraction (XRD), Temperature Programmed Reduction (TPR) were deployed to comprehend the structures of the catalyst and to illustrate the origin of the observed catalytic HDO capacity. Three reactions were done with each chapter. Starting with a HDO reaction for vanillin using palladium over cerium oxide, appreciable loads of guaiacol was produced at a conversion of 95%. The second investigated reaction constitutes gas-phase pyrolysis of anisole with and without introduction of hydrogen molecules. Major observed products include phenol, toluene and benzofuran. Through the last reaction, we investigated HDO of anisole as using four different catalysts to see the effect of these catalysts on the reaction. The products of this reaction consist of phenols, toluene or cresols where the highest conversion of anisole was attained when deploying a nickel cobalt zeolite (Ni-Co-Zeolite) catalyst. Outcomes from this work shall be useful to assess the HDO's capacity exerted by of mixed metal oxides catalysts at mild conditions (intermediate temperatures, ambient pressure, moderate H_2/Feed ratio).