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Aqueous phase reforming of sorbitol over Ca doped Ni/Al_2O_3 for value-added chemicals production

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Abstract

Biomass is currently one of the preferred sustainable and renewable source of energy, with countless potential as a basis for hydrogen and value added chemical production. Various researches has been done to optimize the usage of biomass as the source of energy, one of them is conversion of polyols such as sorbitol to hydrogen and value-added chemicals using the low energy, low temperature, high yield process of aqueous phase reforming, in the presence of suitable and compatible catalyst. In this research, Ni/Al_2O_3 doped with varying percentage of Ca (0.5%, 3% and 5%) are synthesized via wet impregnation method and the resulting catalysts are subjected to various characterization techniques such as TGA, FESEM-EDX, H2-TPR, BET and XRD to assess the physicochemical properties. The catalytic activity test was carried out in a batch reactor (230˚C, 20 bar and 1 hour) and the resulted liquid products were analyzed using HPLC analysis to determine the products formed. Based on the findings, addition of Ca has shown prodigious effect on physiochemical properties of the Ni/Al_2O_3, where addition of Ca resulted in lower reduction temperature, good surface morphology and element dispersion, good surface area and pore size, and good interaction between the metals and support as compared to the pristine Ni/Al_2O_3. Congruently, the addition of various percentages of Ca produces various types of valuable chemicals such as ethanol, 1-propanol, propanal and ethylene glycol at relatively high selectivity percentage, with relatively good sorbitol conversion ranging from 69.09-75.29%.

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