Niobium based macromolecule preparation and its potential application in biomass derived levulinic acid esterification

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Abstract

Niobium incorporated *meso*-tetra-(4-carboxyphenyl)-porphyrin (Nb-TCPP) was prepared for the first time and grafted through the axial position by the surface amine groups present on functionalized SBA-15 (SBA-AM). The synthesized TCPP ligand, Nb-TCPP complex, and the grafted Nb-TCPP-SBA-AM complex were thoroughly characterized by various analytical and spectroscopic techniques such as FT-IR, UV-VIS, DR UV-VIS, CHN, ^{1}H NMR, powder XRD, and N_2 sorption studies. The catalytic activity of the homogeneous Nb-TCPP complex and the heterogeneous Nb-TCPP SBA-AM complex were explored for the esterification reaction of levulinic acid. The studies revealed that Nb-TCPP and Nb-TCPP-SBA-AM showed comparatively good catalytic activity (74-80 % conversion) for the esterification of levulinic acid using methanol under mild reaction conditions with the formation of methyl levulinate and α-angelica lactone as the products.

Keywords: Niobium, Porphyrin, Biomass, Levulinic acid, Esterification, Macromolecule