RUTHENIUM *MESO*-TETRAKIS(4-CARBOXYPHENYL)PORPHYRIN (Ru-TCPP): SYNTHESIS AND ITS APPLICATION IN FURFURAL HYDROGENATION

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Ruthenium containing meso-tetrakis(4-carboxyphenyl)porphyrin (Ru-TCPP) was prepared for the first time by a simple method. The resultant Ru-TCPP molecule was heterogenized on the surface of mesoporous molecular sieve material. The formations of the Ru-TCPP molecule and the heterogenized Ru-TCCP complex (Ru-TCPP-SBA-AM) were thoroughly monitored with the help of FT-IR, UV-Vis, DR UV-Vis, carbon, hydrogen, nitrogen (CHN) elemental analysis, proton nuclear magnetic resonance (^{1}H NMR), powder x-ray diffraction (XRD), and N_2 sorption studies. The catalytic activity of the homogeneous (Ru-TCPP) and the heterogenized Ru-TCPP complex (Ru-TCPP-SBA-AM) was explored for the hydrogenation of furfural. This study revealed that homogeneous Ru-TCPP shows better conversion (60%) compared to heterogeneous Ru-TCPP-SBA-AM catalysts (40%), which can be explained based on the labile axial ligand in the homogeneous catalyst. In addition, furfural hydrogenation yields furfuryl alcohol along with some other hydrogenated products such as tetrahydrofurfuryl alcohol, γ-valerolactone, and 1,5-pentanediol.

KEY WORDS: *ruthenium containing meso-tetrakis(4-carboxyphenyl)porphyrin, amino-functionalized SBA-15, hydrogenation, furfural*

1. INTRODUCTION

Compounds of ruthenium form a wide class of catalysts, which has important synthetic applications in organic chemistry. Ruthenium-based organometallic complexes show numerous applications, owing to their ability to exist in variable oxidation states, ranging from –2 (d^{10}) to +8 (d^0), and their ability to coordinate with various ligands (carbonyl, tertiary phosphines, cyclopentadienyl, dienes, carbenes). Further, ruthenium complexes are relatively less expensive compared to other platinum metals, from an industrial point of view (Mägerlein et al., 2007). Ruthenium-based catalysts promote organic transformations such as hydrogenation (Jessop et al., 1994; Murahashi, 2006), oxidation (Naota et al., 1998; Seehra and Bristow, 2018), C–C bond formation (Jessop et al., 1994), C–H bond activation, olefin metathesis (Frenzel and Nuyken, 2002), carbonylation, isomerization, and steam reforming (Jessop et al., 1994; Murahashi, 2006), etc. In addition, the optically active compounds can be produced by the incorporation of well-shaped chiral ligands into Ru complexes (Murahashi, 2006). These compounds are important in the pharmaceutical and fine chemical industries.

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