Oxovanadium catalyst based on nano-porous carbon xerogel: an efficient heterogeneous nano-catalyst for aerobic oxidation of olefins

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ABSTRACT

Porous carbon xerogels were prepared from the sol-gel polymerization of resorcinol with formaldehyde (RF) followed by carbonization at a high temperature under argon atmosphere. The capacity of the carbon xerogels for direct immobilization of metal complexes was tested with a vanadium(IV) complex, [VIV O(HL)(H 2O)(CH 3OH)], which possesses an extended ligand π system and reactive hydroxyl groups on the L-tyrosine fragment. Textural characterization of the CXG and CXG/[VIV O(HL)(H 2O)(CH 3OH)] have been investigated using N 2 adsorption–desorption at −196°C. Chemical surface groups were analyzed by FT-IR spectroscopy. Nano-particle size and morphology of CXG and CXG/[VIV O(HL)(H 2O)(CH 3OH)] nano-particles have been characterized by scanning electron microscopy (SEM). Catalytic activity of CXG/[VIV O(HL)(H 2O)(CH 3OH)] was investigated in the aerobic oxidation of olefins. The reaction conditions have been optimized for solvent and temperature. CXG/[VIV O(HL)(H 2O)(CH 3OH)] showed higher catalytic activity for the epoxidation of unfunctionalized olefins with molecular oxygen in the presence of isobutyraldehyde. Comparison of the heterogenized catalyst, CXG/[VIV O(HL)(H 2O)(CH 3OH)], with the corresponding homogeneous catalyst, [VIV O(HL)(H 2O)(CH 3OH)], showed that the heterogeneous catalyst had higher activity and selectivity than the homogeneous counterpart. The heterogeneous catalyst was easily recovered from the reaction medium and could be re-used for other five runs without significant loss of activity.

Keywords: Xerogel; Aerobic oxidation; Oxovanadium; Nano-porous; Nano-particles

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