Nano Titania-Supported Dawson Heteropolyacid as Green Solid Catalyst For synthesis of Linear Alkylbenzene

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Linear alkylbenzenes (LABs) are important intermediates for the production of biodegradable synthetic detergents. LABs are traditionally manufactured by alkylation of benzene with C_{10-14} Linear alkenes in the presence of aluminum trichloride ($AlCl_3$) or hydrofluoric acid (HF) as catalyst which are extremely corrosive and the selectivity to 2-phenyl isomers is low. Thus, many efforts have been concentrated on solid acid catalyst for their environmentally friendly manufacture.

The use of heteropolyacids (HPAs), has recently received considerable attention as nontoxic, eco-friendly and environmentally benign catalysts for alkylation reactions and Dawson catalysts are considered to be more effective than those of Keggin type.

The present study deals with the preparation, characterization and application of nano titania-supported Dawson heteropolyacid in the synthesis of LAB. We immobilized Dawson HPA into the titania nanoparticles and the catalytic activities of supported and bulk type Dawson were evaluated in Liquid phase alkylation of benzene with 1-decene. The catalysts were characterized by XRD and FTIR pyridine adsorption and products were identified by GC-MS.

Due to low surface areas and high solubility of Heteropolyacids in polar solvent, we use them in the supported from and the catalytic behavior of supported and bulk type were compared. Titania, a widely used catalyst support, enhances the activity due to the strong interaction between the active phase and the support. And nano sized titania make a higher specific surface area, that is beneficial to the catalytic properties.

It is found that the catalysts exhibit much higher catalytic activity than conventional $AlCl_3$ and HF acid. By using nano titania as the support of Dawson Heteropolyacid, the conversion of 1-decene and yield of 2-phenyldecane increases compared with bulk form of Dawson. At the reaction temperature of 80°C, atmosphere pressure and 2 hr reaction time, the nano titania supported Dawson with 50% loading, showed 1-decene conversion of 87% and 2-phenyldecane selectively of 36%.