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Cerium Ions Grafted on Functionalized Mesoporous SBA-15 Molecular Sieves: Preparation and Its Catalytic Activity on *p*-Cresol Oxidation

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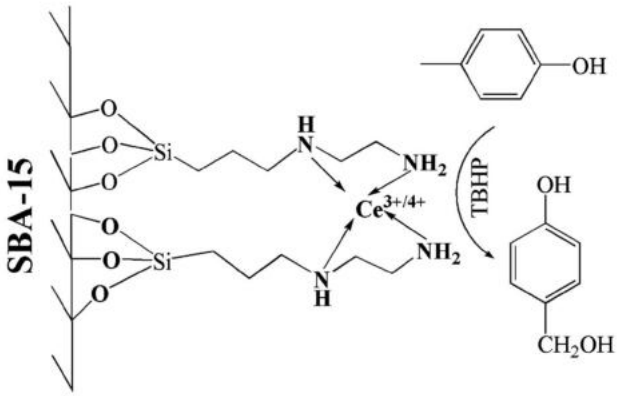
Abstract
Cerium ions were grafted onto the internal surface of organo-functionalized mesoporous SBA-15 molecular sieves by a post-synthesis method. The resultant SBA-DA-Ce materials were fully characterized by various analytical and spectroscopic techniques including powder XRD, N_2 physisorption studies, SEM, FT-IR, DR-UV–Vis, TG-DTA, ^{29}Si and ^{13}C MAS-NMR techniques. The organo-functionality present on the surface was confirmed by the MAS-NMR and FT-IR studies, while the presence of cerium as Ce^{4+} ions was evident from the DR-UV–Vis studies. The catalytic activities of materials with different cerium ion content were assessed in terms of the oxidation of *p*-cresol under varying reaction conditions. The diamine-functionalized SBA-15 with 8 mmol of cerium ions per gram of SBA-15 (i.e., SBA-DA-Ce-8) showed the best catalytic activity, with a *p*-cresol conversion of ~87%.

Graphical Abstract



Cerium ions were grafted on the surface of functionalized SBA-15 by the post-synthesis method. The resultant SBA-DA-Ce showed promising activity on *p*-cresol oxidation with a conversion of 87%.

Keywords Oxidation · *p-Cresol* · *Mesoporous SBA-15* · *p*-Hydroxybenzaldehyde · Rare earths

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1 Introduction

Over the decades heterogeneous catalytic materials have played a pivotal role in variety of industrial processes [1]. The most common heterogeneous catalysts used in industries are metals supported on inert oxides, metal oxides, and porous molecular sieve materials [2]. Recently, the development of environmentally friendly heterogeneous solid catalysts has