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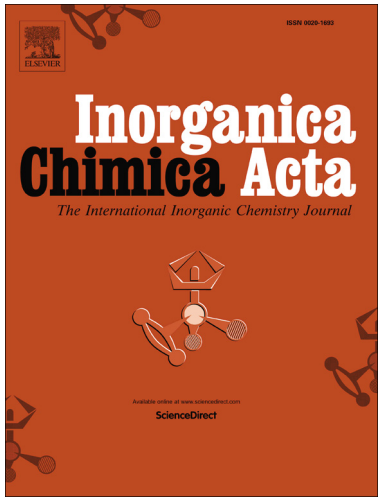

Copper phthalocyanine as an efficient and reusable heterogeneous catalyst for direct hydroxylation of benzene to phenol under mild conditions

Shohreh Farahmand, Mehran Ghiaci, Jala.S. Razavizadeh

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Copper phthalocyanine as an efficient and reusable heterogeneous catalyst for direct hydroxylation of benzene to phenol under mild conditions

Shohreh Farahmand[a], Mehran Ghiaci [a*], Jala. S. Razavizadeh[a]

Abstract

The liquid-phase oxidation of benzene to phenol over copper phthalocyanine as a heterogeneous catalyst was studied at room temperature. Acetonitrile was chosen as the preferred solvent and hydrogen peroxide as an eco-friendly oxidant. The yield and selectivity of 13.9% and 100% were obtained, respectively. The catalyst was characterized by FT-IR, UV-Vis, XRD, TGA, XPS, **^{1}H NMR, ^{13}C NMR, CHN, BET**, FE-SEM, TEM and EDX analysis. The effect of different parameters on the catalytic performance of CuPc were also investigated. The reusability of the catalyst was studied, and the results showed that after five cycles the yield of phenol did not change noticeably, probably due to its stability in the reaction conditions.

Keywords: Copper phthalocyanine; benzene; hydroxylation; phenol; hydrogen peroxide.

1. Introduction

Among the most important raw materials, phenol is a valuable intermediate that has many applications and is widely used for the synthesis of bisphenol-A, phenolic and epoxy resins, polycarbonates, agrochemicals, plastics, and pigments [1–3]. Its current production worldwide might be around 10 million tons per year where a large fraction of it is produced by the cumene process [4]. In this process, cumene is partially oxidized when phenol and acetone are produced in a 1:1 molar ratio via the Hock rearrangement [5], but this process has several disadvantages such as high energy consumption, low yield of phenol, production of by-product and environmental problems. Therefore as a chemical industry perspective, **the goal will be to produce phenol using an eco-friendly oxidant such as molecular oxygen** [6], or hydrogen peroxide [7].

[a]Department of Chemistry, Isfahan University of Technology, Isfahan, Iran
[*]Corresponding author. Tel.: +98 311 391 3254; fax: +98 311 391 2350; P. O. Box. 8415683111
E-mail address: mghiaci@cc.iut.ac.ir (M. Ghiaci).

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