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Selective dinitration of toluene over zeolites

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Nitro compounds are very important intermediates for the production of a number of industrial products such as pharmaceuticals, dyes, polymers, and fertilizers. For example, 2,4 dinitrotoluene can be used for the production of Toluene diisocyanate (TDI) and Toluenediamine that can be used to produce Polyurethane, which is widely used in wheels, furniture and has many other applications. We have investigated the dinitration of toluene and nitrotoluenes over zeolite under various reaction conditions with the aim to produce 2,4-DNT region-selectively and with a high yield where various acid anhydrides were used along with various quantities of zeolites and reagents. Nitration of toluene with chloroacetic anhydride over Hβ produced 2,4-dinitrotoluene in 98% yield in which 2,4-:2,6-DNT in a ratio of 49:1. Also, propionic anhydride under similar reaction conditions produced 2,4-DNT in 98% with an excellent 2,4-:2,6-DNT ratio of 123:1. This result is simply the highest for direct dinitration of toluene ever recorded, and in contrast to the traditional method, the system containing propionic anhydride, nitric acid, zeolite Hβ gave excellent yield of 2,4-dinitroyoluene with excellent selectivity and the only by-product produced during this process was the propionic acid which can be recycled easily. Also, the zeolite can easily be removed from the reaction mixture by a simple filtration, then activated and reused to give good results for several times with or without calcinations. The system was applied successfully to various mono-substituted benzenes (e.g. alkyl and akyloxybenzene). All reactions appeared to be extremely selective for production of 2,4 dinitro isomer or 4-mononitro derivative but highly active anisole and phenetole produced excellent yields for the corresponding 2,4-dinitro derivatives (97% and 96%, respectively).

Biography

Mohammad Hayal Alotaibi has completed his PhD from School of Chemistry, Cardiff University in the year 2008. His research involves development of novel organic synthetic methods, especially ones that are greener than traditional methods and also, has great interest towards synthesis of compounds with interesting properties. His current research projects involve use of zeolites and solid-supported reagents as catalysts to gain region-selectivity in organic reactions. In addition, he is interested in heterogeneous catalysis especially supported by metal nanoparticles containing gold and palladium. He is a member of many associations including Royal Society of Chemistry (RSC), the American Chemical Society (ACS), American Academy of Forensic Science (AAFS) and the Saudi Chemical Society.

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