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ORIGINAL ARTICLE

Sand: A natural and potential catalyst in renowned Friedel Craft's acylation of aromatic compounds

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Abstract The aim of this work is to develop a cheap and green chemical process and this paper describes the catalytic commotion of locally collected sand in Friedel–Craft's Acylation of aromatic compounds like benzene, anisole, aniline, naphthalene and phenol etc. The sand consists of silica and alumina as analyzed by means of EDAX and acts as a green Lewis acid. The catalyst was also characterized by using BET, SEM, and XRD techniques.

1. Introduction

Friedel–Craft's acylation is the most imperative technique for the preparation of aryl ketones. This is an electrophilic substitution reaction and takes place in the presence of Lewis acid such as anhydrous $AlCl_3$ (Friedel and Crafts, 1877). The exhausted catalyst in this conventional reaction is noxious, hard to recover and in addition it is extremely complicated to separate product from the used up catalyst. Therefore, there is need for the innovative catalyst which is non-hazardous and unproblematic to separate. Literature survey reveals that there are assortments of catalysts which are functional in support of Friedel Craft's (Alkylation/Acylation/Benzoylation) reactions. Some examples of these catalysts are montmorillonite supported $ZnCl_2$ and $NiCl_2$ ((Clark et al., 1994) Clay (Farkes et al., 2000) Zeolites (Coq et al., 1993; Wang et al., 1995) Cesium modified dodecatungstophosphoric acid (DTP) on clay (Yadav and Badure, 2008) coal fly ash (Ojha et al., 2005) solid acid (Eghtor and Pinnavia, 1991; Yusuke et al., 1995; Chiche et al., 1986)) inorganic solid supported reagent (Bastock et al., 1994) poly acid salt (Izumi et al., 1995) ReBr (CO)5 (Kusama and Naraska, 1995) FeCl3 on K – 10 (Pai et al., 1997) some chlorates like LiClO4 complex (Bartoli et al., 2002) La (OTf)3 – LiClO4 (Kawada et al., 1961) trifoliate like Sc (OTf)3 (Cui et al., 2003) During recent times several metals like Al (Krishna et al., 2005), Sb (Pasha et al., 2007) Zn (Paul et al., 2003) and metal oxides like AI2O3 (Ranu et al., 1996; Niasari et al., 2004) ZnO (Sarvari and Sharghi, 2004) TiO2 (Pasha et al., 2006) are also employed for Friedel Craft's reaction. Sand is a natural substance, which has been used as an adsorbent and hence for purification of water. This adsorbing

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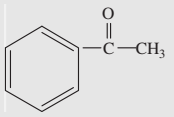
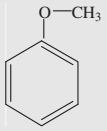
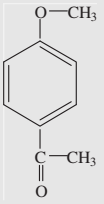
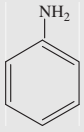
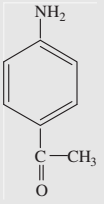
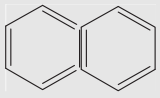
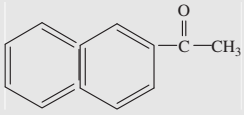
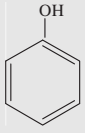
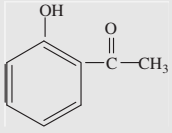
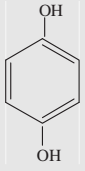
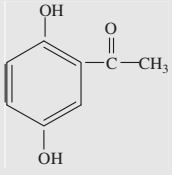
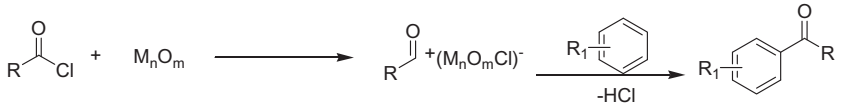
Table 1 Sand catalyzed Friedel–Craft's acylation of aromatic compounds.

S. No.	Substrate	Product	Reaction Temp. (°C)	Time (h)	% Yield
1			50–52	3	76
2			65–67	3.5	65
3			40–42	3.5	75
4			43–45	5	73
5			50–51	5	65
6			43–45	5	70

capacity makes it as an excellent as well as a green catalyst, which is effortlessly separable, non-hazardous and economical. Consequently, we decided to investigate the competence of sand to accomplish Friedel Craft's acylation reaction.

2. Experimental

The sand used for our experimental purpose was collected from Manjara River at Biloli Dist. Nanded Maharashtra India. It was washed several times by distilled water and then ground to a fine powder in order to enhance surface area. The powder was treated with nitrating mixture to remove organic impurities and again washed with distilled water to make it free from the acid. The sample was then heated up to 350 °C for 4 h to remove moisture and convert Bronstead acid sites to Lewis ones (Cant and Little, 1966) and was subsequently used for catalytic purpose. Friedel Craft's acylation of benzene and its derivatives were carried out in liquid phase in a round



M=Si or Al and n=1, 2….. m=2, 3…….

Scheme 1