ELECTROPHILIC ALKYLATION OF BENZENOIDS WITH 2-PROPANOL USING Al^{3+}- MONTMORILLONITE CLAY CATALYST

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$AlCl_3$, $FeCl_3$, $SnCl_4$ and $SbCl_5$ are commonly used as Lewis catalysts in alkylation reactions. Such catalysts have drawbacks that include corrosiveness, loss of catalytic process, environmental problems and formation of unwanted side products. Usually organic halides are used in alkylation reactions. These halides produce undesirable by-products. Therefore alcohols are more suitable alternatives for organic halides in alkylation reactions. Usually alkylation using alcohols requires high temperatures (350- 400 ^{0}C), mineral acids as catalysts and high pressure to obtain optimum yields. Therefore, the development of a more economical process for alkylation using alcohols is useful.

Solid acids catalysts that may replace conventional Lewis acids can be prepared from clay minerals such as montmorillonite. Montmorillonite is a layered aluminosilicate, composed of a sheet of octahedrally coordinated gibbsite $[Al_2(OH)_6]$ sandwiched between two sheets of tetrahedrally coordinated silicate $[SiO_4]^{4-}$. The three-sheet layer repeats itself. The isomorphous substitution can be seen in either the octahedral sheet (low charge species Mg^{2+}, Fe^{2+} substituted for Al^{3+}) or the tetrahedral sheet (Al^{3+} or Fe^{3+} substituted for Si^{4+}) of the montmorillonite. These isomorphous substitutions lead to net negative charges on the clay structure. The layer charges are balanced by the uptake of cations into the inter layer spaces. Such cations are easily exchanged to prepare various type of cation-exchanged clay such as Al^{3+}-montmorillonite. Al^{3+}-exchanged clay shows high Brønsted acidity due to protons in the interlamellar zone being formed by the polarization of co-coordinated water molecules by the small highly charged Al^{3+} cations. Al^{3+}-montmorillonite was prepared by stirring montmorillonite with an aqueous solution of $AlCl_3$. The XRD pattern of the oven dried Al^{3+}-montmorillonite (basal spacing 17.85 Å) was similar to that of raw montmorillonite (basal spacing 15.37 Å).

Al^{3+}-montmorillonite was used as a solid acid catalyst in the reactions of 2-propanol with benzene, bromobenzene and methoxybenzene under reflux conditions. Benzene produced cumene while bromobenzene and methoxybenzene produced the corresponding *ortho* and *para* substituted alkyl derivatives in 26-40% yield in the preliminary experiments; yields are yet to be optimized. Products were identified by using FT-IR spectroscopy, gas chromatography and/or ^{1}H NMR spectroscopy. Modified montmorillonite clay may be useful in developing environmentally friendly technologies to prepare industrially important compounds such as cumene; cumene is the starting material for the industrial production of phenol.

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