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Investigation of the co-polymer structure effect on the catalytic performance of resin-supported pyrrolidine heterogeneous catalysts in aldol reactions

Aim

Investigating the influence of the co-polymer structure on the catalytic activity of resin catalysts in aldol reactions. Synthesising and characterising copolymers comprising poly(ethylene glycol) methacrylate and butyl methacrylate units with ordered/random sequence distributions aiming at varying hydrophobic/hydrophilic properties. Functionalising the resin-supported with pyrrolidine and evaluate their performance in the model aldol reaction of 4-nitrobenzaldehyde with acetone in various solvents.

Justification

Aldol condensation is one of the most important C–C forming synthetic methods extensively used in industrial relevance either in bulk production, or in the fine chemical and pharmaceutical industry. This reaction is currently performed in the presence of homogeneous or heterogeneous catalysts. However, most researchers prefer to use heterogeneous catalysts to avoid pollution problems and the issues related to separation and recovery of the products. Therefore, a variety of heterogeneous catalysts such as mixed oxides, zeolites, aminated resins and mesoporous silica have been reported for this valuable reaction. Among them, amine functionalized poly(ethylene glycol) methacrylate-based resins have received special attention owing to their unique properties including availability of the internal surface area for reactants due to their swelling ability in various solvents, sufficient tolerance against degradation reactions and fast recyclability. However, due to the different polarity of the solvents that can be used for aldol condensation reactions, changing the structure of the poly(ethylene glycol) methacrylate-based resins to produce an efficient heterogeneous catalyst with hydrophobic or hydrophilic nature in various solvents is still needed.

Since the structure of the support and its interactions with different solvents play an important role in performance of the produced catalysts, we want to investigate the influence of the co-polymer structure on the catalytic activity of the catalysts in various solvents.

Program

Different co-polymers comprising poly(ethylene glycol) methacrylate and butyl methacrylate units with ordered/random sequence distributions will be synthesized and used to produce a series of resin-supported pyrrolidine heterogenous catalysts. These catalysts will then be used in the model aldol reaction of 4-nitrobenzaldehyde with acetone and their catalytic activity will be evaluated in various solvents. These experiments will be performed in both a batch-type reactor, for assessing the catalytic activity, as well as a continuous flow reactor, for assessing the stability.