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Secondary amine functionalized poly(ethylene glycol) methacrylate-based catalyst for aldol reactions

Aim

Study of the effect of secondary amine functionalities on the performance of poly(ethylene glycol) methacrylate-based catalysts in aldol reactions.

This work involves the synthesis and characterization of catalysts derived from poly(ethylene glycol) methacrylate (PEGMA) and poly(ethylene glycol) dimethacrylate via bulk polymerization with different secondary amine functionalities, followed by evaluation of their catalytic activity in the aldol condensation of 4-nitrobenzaldehyde with acetone across various solvents.

Justification

Aldol reactions are among the most important synthetic strategies for forming carbon–carbon bonds. It is widely applied in the production of numerous compounds across fields such as agriculture, chemicals, flavours and fragrances, and the pharmaceutical industry. Currently, these reactions are industrially performed using homogeneous catalysts (e.g., mineral acids or bases). However, heterogeneous catalysts have attracted substantial interest because they can be easily separated from the reaction mixture, reused, and are generally more environmentally friendly. As a result, a variety of heterogeneous systems; including mixed oxides, zeolites, aminated resins, and mesoporous silica; have been explored for this important transformation. Among these, amine-functionalized poly(ethylene glycol) methacrylate-based resins have gained particular attention due to their distinctive advantages, such as accessible internal surface area for reactants, strong resistance to degradation, and rapid recyclability. However, the structure of these resins can be further optimized to enhance their catalytic performance through the use of different polymerization techniques and functionalization approaches. Therefore, employing bulk polymerization as a straightforward synthesis method, combined with various secondary amine functionalities, appears to be a promising strategy for developing efficient catalysts for the aldol reaction.

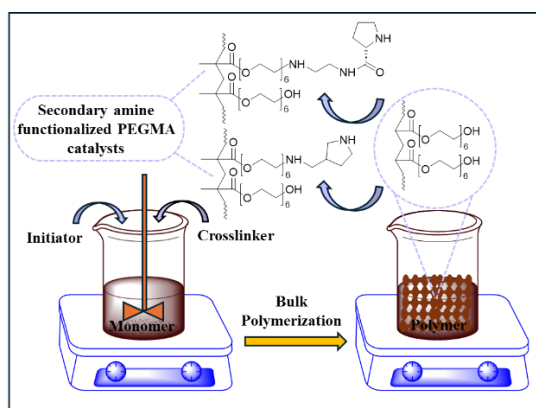


Figure 1. Schematic overview of the process.

Program

A range of PEGMA-based catalysts will be prepared through bulk polymerization and subsequently functionalized with different secondary amines. The resulting catalysts will be applied in the model aldol reaction between 4-nitrobenzaldehyde and acetone, and their catalytic performance will be assessed in various solvents.