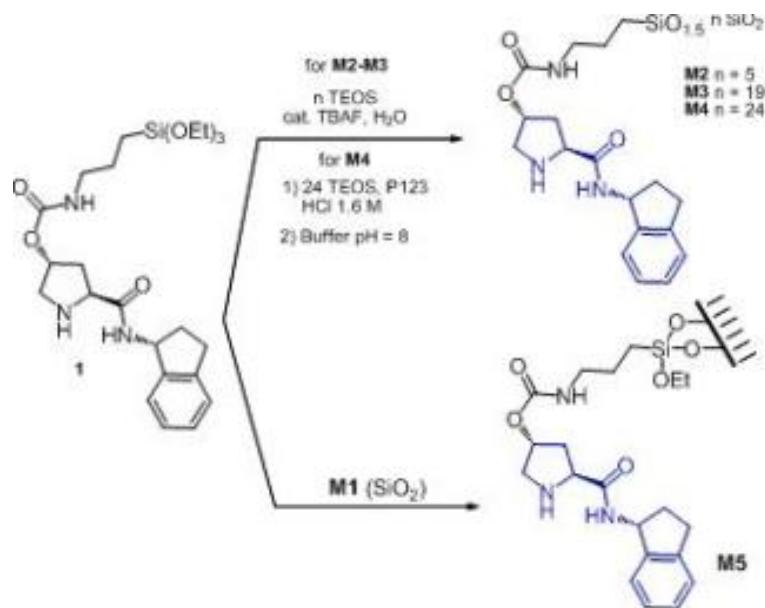


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New recyclable organocatalyst with economic and environmental benefits



UAB researchers have developed a new chiral organocatalytic and recyclable material that promotes aldol reactions, in which two carbonyl compounds produce a new molecule, without the use of metallic complexes. The immobilization of the organocatalyst facilitates the separation and reuse of the final product, causing economic and environmental benefits.

In an aldol reaction two carbonyl compounds give rise to a new molecule by forming a new carbon-carbon bond and converting one of the carbonyls into an alcohol moiety. The induction of asymmetry in such reactions can be achieved by means of an organocatalyst, which is a chiral molecule capable of promoting chemical transformations in a selective manner in the absence of metal complexes. This property may be important and critical for medical applications, where the use of metallic species is currently being reduced to avoid undesired toxic metal traces.

Even though a catalyst is not consumed during the process, its separation from the final products is not always easy. Therefore the recovery and reuse of this type of molecules remains a

scientific challenge of economical and environmental relevance. In this context, one of the most widely applied strategies consist on the immobilization of the organocatalyst onto a polymeric support, which allows a simple separation by filtration and an easy purification of the final products.

Following previous studies in our research group, we have chosen silicon dioxide as inorganic support because of its high thermal, chemical and mechanical stability. The catalytic function of the new materials arises from the organic part, which is a prolinamide moiety (in blue in the figure) permanently anchored to the inorganic network.

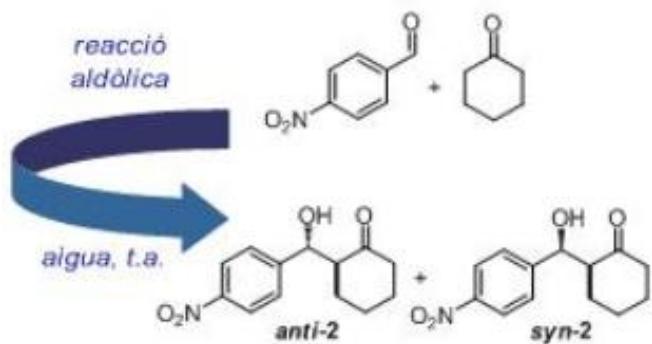


Figure 1: Example of an asymmetric aldol reaction.

The incorporation of this catalytically active unit within the inorganic network has been performed by different ways in order to study the effect of the materials physical properties in their organocatalytic activity. Materials **M2-M5** have been prepared by sol-gel hydrolysis and condensation of a silylated precursor 1 with tetraethoxysilane under different conditions. The hybrid materials obtained have been fully characterized and they have been applied to asymmetric aldol reactions (figure).

With a very simple experimental procedure **M2-M5** give excellent yields, *anti/syn* ratios and enantiomeric excesses. In terms of efficiency and asymmetric induction, we have improved the results obtained with a similar supported prolinamide recently reported by us. The new materials give even better performances than the non-immobilized prolinamides, with the added advantage of recycling up to five consecutive runs without significant loss in activity or selectivity. Moreover, materials **M2-M5** fit the green chemistry requirements since reactions are performed in water, at room temperature and with low organocatalyst loadings (1-10 mol%).

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References

"Recyclable silica-supported prolinamide organocatalysts for direct asymmetric Aldol reaction in water" Monge-Marçet, A.; Cattoën, X.; Alonso, D. A.; Nájera, C.; Wong Chi Man, M.; Pleixats, R. *Green Chem.* 2012, 14, 1601-1610.

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