

## Small organic molecules as catalysts for asymmetric direct aldol reactions in aqueous media: A green chemistry approach for industrial applications

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Presently asymmetric organocatalysis in aqueous media is one of the most focused areas of research field in asymmetric synthesis. Asymmetric carbon-carbon bond forming reactions occupy the central area in the field of asymmetric organic synthesis where aldol reaction is the vastly studied one. A wide range of smart organic materials, including proline and its derivatives have been proved to be efficient catalysts for asymmetric aldol reactions. In recent years, more attention has been paid to develop organocatalysts for the asymmetric direct aldol reactions in water because it provides some unique properties, which include large cohesive energy density, very high surface tension, hydrophobic effect and most importantly it is environmentally benign solvent. The development of asymmetric organocatalyzed direct aldol reactions in aqueous media, for example, a very small organocatalyst, L-Proline hydrazide has been used for direct asymmetric aldol reaction of various ketones with aromatic aldehydes at room temperature in presence of several acid additives. A loading of 10 mol% of the catalyst and p-toluenesulphonic acid as additive was employed in this reaction, and good yields (up to 99%), with high anti/syn diastereoselectivities (up to 95:5) and enantioselectivities (up to >99.9%) could be achieved in aqueous media. Another new organocatalyst, derived from 4-hydroxy-L-proline and abietic acid was used for aldol reactions between substituted aromatic aldehydes and various ketones in presence of several acid additives in aqueous media. The corresponding aldol products were obtained in high isolated yields (up to 99%) with high anti-diastereoselectivities (up to 94%) and enantioselectivities (>99.9%). The catalyst loading was reduced to as low as 1 mol% only and very significantly, the aldol reactions were found to be extremely fast in water. In addition to the development of the above organocatalysts, the effect of several acid additives was investigated in asymmetric direct aldol reaction catalyzed by a C<sub>2</sub>-symmetric organocatalyst in aqueous media.

### Biography

Kartick C Bhowmick research focus on the development of asymmetric organocatalysis for carbon-carbon bond-forming reactions in aqueous media. His research on the development of small organic molecules as organocatalysts for direct aldol reaction impacted significantly in the field of asymmetric organocatalysis. He has developed many optically pure organic molecules which efficiently catalyzed the direct aldol reactions with great yield and selectivity in aqueous media. His newly developed methodology replaced the use of volatile organic solvents and hazardous metal catalysts in asymmetric aldol reactions, thus by contributing enormously towards the development of sustainable organic synthesis.

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