Organocatalytic hydroboration of imines, nitriles, and amides using choline-based ionic liquids

B. Krupa[1,2] M. Nowicki[1], J. Szyling[1] and J. Walkowiak[1]

[1]Center for Advanced Technologies, Adam Mickiewicz University, Uniwersytetu Poznanskiego 10, 61-614 Poznan, Poland

[2]Faculty of Chemistry, Adam Mickiewicz University, Uniwersytetu Poznanskiego 8, 61-614 Poznan, Poland
*barbara.krupa@amu.edu.pl

Ionic liquids are salts usually consisting of an organic cation and an inorganic or organic anion, with a melting point below 100 °C. They are being considered as a green alternative to many chemical and physical processes, due to their unique properties, e.g. low vapor pressure, non-flammability, very low corrosivity, and physical and chemical stability [1]. Choline-based ionic liquids attract significant interest due to their low toxicity and biodegradability [2], and have been established as organocatalysts among a wide range of organic transformations [3].

The chemistry of nitrogen compounds has an enormous role in industry due to their great biological importance. They are key compounds in the synthesis of e.g. pharmaceuticals [4], agrochemicals [5], and natural products [6]. In recent years, several organocatalysts have been employed in hydroboration of imines and nitriles[7]. Almost all existing organocatalytic methods suffer from catalysts requiring several synthesis steps. Moreover, the systems are sensitive to moisture and air, and there is a lack of methods to reuse the catalyst. The search for easy-to-handle, readily available, stable in air and moisture, and recyclable organocatalysts for the hydroboration of unsaturated carbon-nitrogen bonds is of great importance.

Herein, the application of choline-based ionic liquids as organocatalysts in the hydroboration of imines, nitriles, and amides are reported. The mild reaction conditions, low catalyst loading, and high functional groups tolerance were achieved. Moreover, by the application of the one-pot hydroboration sequence and coupling reactions, it was possible to obtain amides, imines, and primary, secondary, and tertiary amines from nitriles with high yields. Within the studies, the recyclability of the catalyst was proved by carrying out repetitive batch experiments. The NMR study and DFT calculations were employed to better understand the reaction mechanism [8].

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