HOLISTIC UNDERSTANDING OF ALCOHOL DEHYDROGENASE CATALYSIS IN DEEP EUTECTIC SOLVENTS

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Biocatalysis has been shifting from traditional aqueous to non-aqueous media in the spirit of *Green Chemistry*. The use of oxidoreductases (EC.1) in non-conventional media plays an indispensable role in the synthesis of a variety of value-added chiral compounds.[1a] Deep eutectic solvents (DESs) represent a new class of greener solvents that are highly tunable.[1b] Redox biocatalysis in DESs combines the two dominant assets of selectivity of enzymes and versatility of DESs.[1c, d] The rational design of redox biocatalysis in DESs requires a comprehensive knowledge of the effects of DESs on enzymes. Exemplarily, the impact of DESs on oxidoreductases has been holistically studied by assessing the catalytic performance of alcohol dehydrogenases (ADHs) in DES-water mixtures (e.g., choline chloride-glycerol, ChCl-Gly, 1:2) with the aid of experimental analysis and molecular dynamics (MD) simulations.[2a, b] It was revealed that enzyme activity is positively related to water activity due to solvation changes surrounding enzymes. In addition, the individual DES components showed discrepant effects, e.g., positive (in case of Gly) or negative (in case of ChCl), promoting the generation of an enzyme-compatible eutectic mixture by increasing the Gly fraction (ChCl-Gly, 1:9).[2c] Based on that, the Gly-based DESs with non-ChCl as HBAs (choline acetate and betaine), namely ChAc-Gly (1:2) and Bet-Gly (1:2), are envisioned to be more enzyme-friendly (**Fig. 1**).

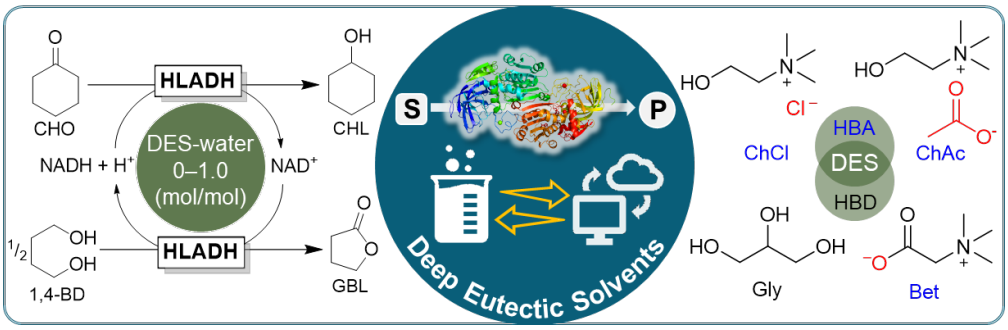

Figure 1: Analysis of horse liver alcohol dehydrogenase in glycerol-based deep eutectic solvents containing various water content (0–100 vol.%) by combining experiments and simulations.

Expectedly, the selected enzyme, horse liver ADH (HLADH), exhibited highly improved stability in both DESs, especially in Bet-Gly. Further studies on different molar ratios and individual components of DESs were conducted to fully elucidate the relationship between the studied DESs and enzymes.

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