

Biocatalysis in Sustainable Solvents Made from Chicken Feed and Fertilizer

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Deep eutectic solvents (DES's) are eutectic mixtures of ammonium or metal salts and hydrogen bond donors. For example, 1:2 mixture of choline chloride (an ingredient in chicken feed) and urea (fertilizer or animal waste product) or a 1:2 mixture of choline chloride and glycerol (biodiesel byproduct) form liquids at room temperature, Figure 1. They are alternatives to conventional organic solvents. Besides having low vapor pressure and low flammability, DES's are composed of nontoxic and inexpensive materials including vitamins, amides, sugars, and alcohols. Many of these components are natural products or can be made from renewable materials, meaning that DES's are a sustainable alternative to many petroleum-based organic solvents. In our work, we apply DES's as alternative solvents for hydrolase-catalyzed reactions. We have found DES's as suitable solvents for a variety of reactions, including perhydrolysis, and transesterification, Figure 2.

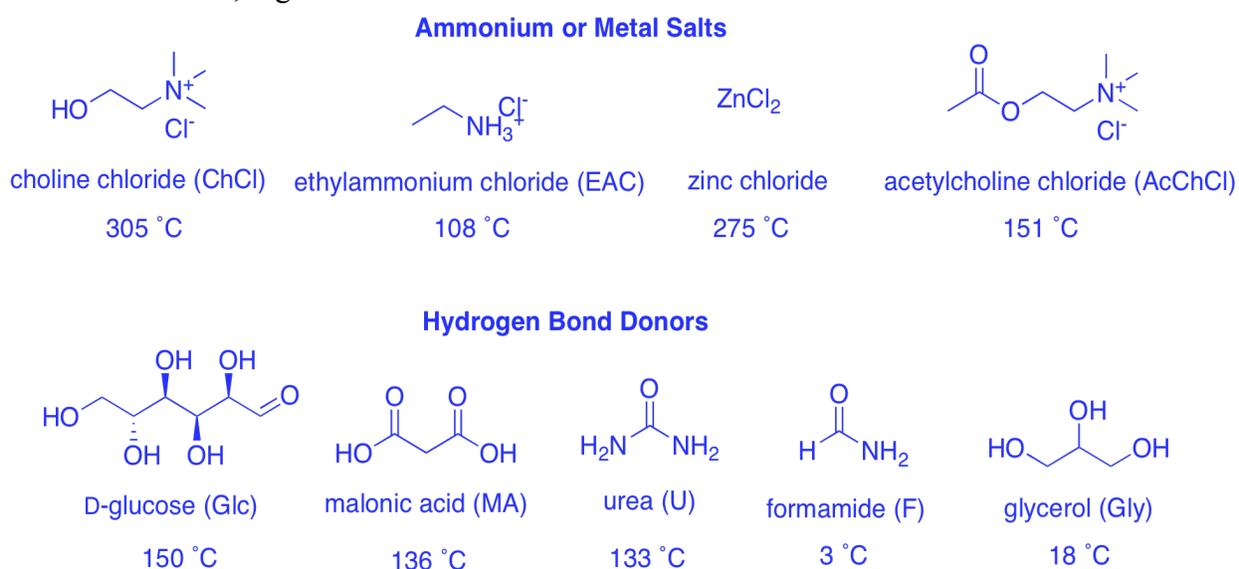


Figure 1. Example DES components and their pure-component melting points. At the eutectic ratio, the salts and hydrogen bond donors form liquids at room temperature or slightly above room temperature

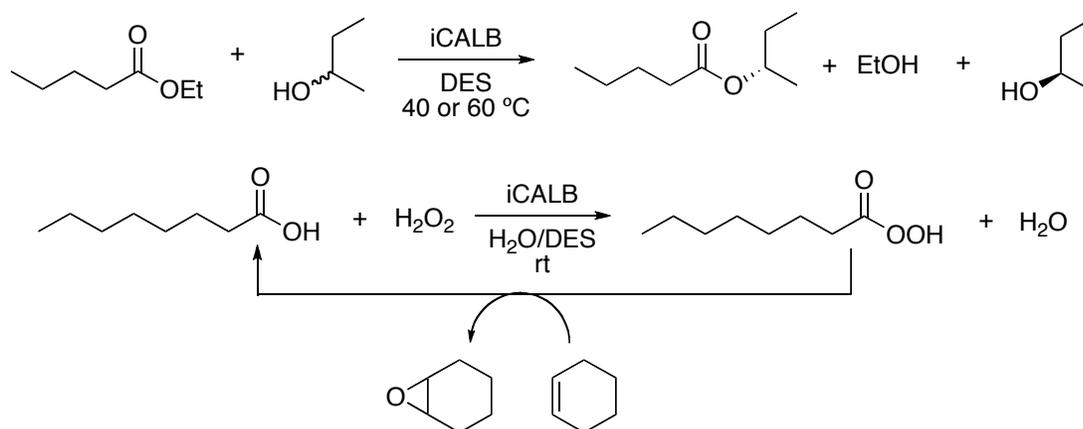


Figure 2. Examples of reactions in DES's. The top reaction is a transesterification reaction with no water present; the bottom reaction is a perhydrolysis in a combination of DES and water.