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Recovery of α chitin and minerals from marine biomass by using deep eutectic solvents

Bojana Bradic, Uros Novak and **Blaz Likozar**
National Institute of Chemistry, Slovenia

The waste generated during the industrial processing of shrimp is about 40–50% of its total weight. Due to the increased world production and consumption of shrimp, the seafood industry is focused on an appropriate destination and/or reuse of this waste, since its improper disposal causes serious environmental problems; in fact, this waste can be utilised for production of importable components. [1] Shrimp shells waste consists primarily of protein (30-40 %), mineral salts (30-50 %), chitin (20-30 %), and small quantities of lipids and pigments. Chitin is considered the second most abundant organic resource on the earth next to cellulose with annual production of around 2million ton. [2] It is nitrogenous polysaccharide, a copolymer of N-acetyl-D-glucosamine and D-glucosamine units linked by a β-(1–4) glyosidic bond, and it is structurally similar to cellulose, having acetamido groups at the C-2 positions instead of the hydroxyl group. Chitin is mainly used as a raw material to produce chitin-derived products, such as chitosan, oligosaccharides and glucosamine. An increasing number of useful products derived from chitin continue to attract commercial development. Chitin has become of great interest not only as under-utilised resource but also as new functional biomaterial of high potential in various field and huge potential nitrogen source. [3] According to the current research, the extraction of α-chitin is classified into two different procedures, the chemical and the biological isolation. Traditionally, the chemical method employs strong acid and alkali to remove minerals and proteins, respectively. However, this method will produce a large number of environmentally hazardous and corrosive acid-base wastewater. As an alternative many studies have been performed in relation to the utilization of biological methods including enzymatic reactions and microbial fermentation, which due to the longer fermentation cycles and expensive enzymes could prevent the promotion of these methods. [4] Green technology actively seeks new solvents to replace common organic solvents that present inherent toxicity and have high volatility, leading to evaporation of volatile organic compounds to the atmosphere. Ionic liquids (ILs) and deep eutectic solvents, thus, have been paid great attention to replace current harsh organic solvents and have been applied in many chemical processing such as extraction and synthesis. Multi-disciplinary studies on ILs are emerging, including chemistry, material science, chemical engineering and environmental science. [5] However, the limitation of Ils, such as toxicity, poor biodegradability and high cost have been reported in current literature. Deep eutectic (DES), as part of green concept is present as a widely acknowledged type of ionic liquid, analogies of Ils, because both share many same properties and characteristics. DES recently has shown their usefulness as environmentally benign sustainable alternative to the conventional organic solvents in synthetic chemistry to increase efficiency of organic transformations and synthesis. This type of solvents is a fluid generally composed of two or three cheap and safe components that are capable of self-association, often through hydrogen bond interactions, to form a eutectic mixture with a melting point lower than that of each individual component. DESs are generally liquid at temperatures lower than 100°C, and contain long nonsymmetric ions that have low latticeenergy and low melting point. [6] With the discovery of DES, the properties of DESs have attracted considerable importance. This study brings a new approach for the recovery of α-chitin and minerals from shrimp shells by using deep eutectic solvents (DES) consisting of the mixtures of Choline Chloride-Lactic Acid (CCLA), Choline Chloride-Malonic Acid (CCMA), Choline Chloride-Urea (CCU) and Choline Chloride-Citric Acid (CCCA) .

Bojana.Bradic@ki.si