



Facile Production of 5-Hydroxymethylfurfural from Green Macroalgae Using a Deep Eutectic Solvent System

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Abstract

Macroalgae biomass can be considered as a potential feedstock for sustainable production of bio-energy and/or bio-chemicals since it can grow much faster than conventional crops, and also mainly consists of cellulose and hemicellulose components. In this work, selective conversion of green macroalgae (*Ulva lactuca*) into high value-added 5-hydroxymethylfurfural (5-HMF) was investigated in detail using a deep eutectic solvent (DES) system. The co-application of hydrochloric acid (hydrogen bond donor) and choline chloride (hydrogen bond acceptor) in the DES system, including the synthetic temperature and time, was carefully studied to find the optimum conditions for 5-HMF production via hydrolysis, isomerization and dehydration. The highest yield of 5-HMF (93.9%) was obtained at a synthetic temperature (120 °C) and time (90 min) using loading amounts of hydrochloric acid (2.4 mmol) and choline chloride (28 mmol). The polymerization of 5-HMF into humins possibly occurred under harsh conditions, leading to an obvious decrease in 5-HMF yield. Acetonitrile was revealed to be a green solvent for 5-HMF production, and the spent choline chloride could be easily recrystallized and reused up to five cycles under the DES system. This work provides a sustainable method for catalytic production of 5-HMF with high yield from green macroalgae biomass.

Keywords: green macroalgae, 5-hydroxymethylfurfural, deep eutectic solvent, choline chloride