Green extraction of palmitic acid from palm oil using betaine-based natural deep eutectic solvents

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Abstrak

In the palm oil refining processes, the free fatty acid content is reduced to an acceptable level by using steam-stripping that causes, also, the loss of nutraceuticals such as tocopherols and carotenoids. An alternative method, such as solvent extraction, to separate free fatty acids, especially palmitic acid as the major free fatty acid present in palm oil, will conserves not only the important nutraceuticals but, also, conserves energy because a steam requirement is eliminated. The objective of this research is to evaluate the performance of Natural Deep Eutectic Solvents (NADES), each consisting of betaine as the hydrogen bonding acceptor and a polyalcohol as the hydrogen bonding donor, to extract palmitic acid from palm oil. The goal is to obtain a NADES that is able to extract palmitic acid from palm oil with the highest extraction yield. The viscosity of various studied NADES was 10-236 cSt while the polarity parameter, determined by using Nile red as the solvatochromic dye, was 48.9-50.8 kcal/mol. The obtained data shows that, for NADES having similar polarity to that of betaine, the extraction yields reduce with increasing viscosity of the NADES. The highest extraction yield of 60% (w/w), corresponding to a distribution coefficient value of 0.75, was obtained by using NADES consisting of betaine and 1,2-butanediol. The extraction yield and distribution coefficient values indicated the potential of NADES, prepared by friendly compounds of betaine and polyalcohols, as alternative green solvents in the solvent extraction process when separating free fatty acids from palm oil.