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One-pot extraction and separation of bacterioruberin using a hydrophobic eutectic mixture

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PURPOSE OF THE ABSTRACT

A petroleum-based economy can no longer supply the needs of the population. Climate change mitigation requires a significant reduction in greenhouse gas emissions and sustainable technologies and practices must be developed in this context for an efficient transition to a renewable bio-based economy. Multi-product biorefinery strives to fully valorise the biomass by creating as many commercially relevant products as possible while minimising waste effluents. One of the fundamental challenges in promoting effective multi-product biorefinery is the development of sustainable and efficient extraction and fractionation procedures that allow the recovery of various biomolecules while maintaining their structural integrity and properties. The shift towards a biorefinery approach has engendered a corresponding need for new bio-based or bio-sourced solvents to substitute the current petroleum derived ones. Deep eutectic solvents (DES) represent a mixture of Lewis or Bronsted base and acid, emerging as a promising class of neoteric solvents. Their properties can be freely modulated through judicious selection of their components, allowing them to replace or improve on existing solvents.
In line with the biorefinery ethos, the valorisation of Haloferax mediterranei ATCC 33500 was pursued in this work using hydrophobic DES using a ?one-pot? methodology for the solid-liquid extraction and subsequent separation of the pigment and protein fraction using water as a counter solvent. Haloferax mediterranei is a highly promising marine extremophile bacteria for the production of bacterioruberin owing to its rapid growth and ability to consume a variety of carbon sources. Bacterioruberin is a rare C50 carotenoid with significant biotechnological potential in the food and pharmaceutical sectors. The increased number of pairs of conjugated double bonds in this type of carotenoid explains why it has a better antioxidant ability than C40 carotenoids (such as ?-carotene). Operational conditions such as the eutectic component selection, eutectic concentration, eutectic molar ratio, solid-liquid ratio and the time of extraction were assessed and optimised using an experimental design. The chosen DES outperformed common solvents, could be reused up to four times with no loss in efficiency, and yielded a final extract compatible with food and cosmetic grade applications. Finally, the pigment was shown to be stable for over a week in the final extract.

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FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Bacterioruberin | Carotenoid | Eutectic | Extraction

BIBLIOGRAPHY