Molecular Catalysis • *Open Access* • Volume 528 • August 2022 • Article number 112422

Document type
Article • *Green Open Access*

Source type
Journal

ISSN
24688231

DOI
10.1016/j.mcat.2022.112422

Publisher
Elsevier B.V.

CODEN
MCOAD

Original language
English

View less

Nanocellulose and natural deep eutectic solvent as potential biocatalyst system toward enzyme immobilization

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Abstract

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Abstract

This study reports the immobilization of Candida Rugosa lipase (CRL) onto nanocellulose (NC) extracted from almond shells using p-toluenesulfonic acid (PTSA) and sulfuric acid (ASS) with sugar-based natural deep eutectic solvent (NADES1a) as a biocatalyst system . The properties of both immobilized lipases were studied and compared to the free enzyme counterpart. Under optimized conditions (2 h, 40 ºC and pH 7.0), the immobilized CRL-PTSA-NADES1a and CRL-ASS-NADES1a gave a maximum specific activity of 4.9 U mg^{-1} and 6.57 U mg^{-1}, respectively, compared to the free CRL (4.52 U mg^{-1}). Both immobilized CRL showed better thermal stability, high catalytic activity and reusability up to 7 consecutive cycles. The half- life of the immobilized lipase was 14 ~ 16 days greater than free lipase (27 days). The Brunauer-Emmett-Teller (BET) surface area of NC-ASS (20.76 m^2 g^{-1}) is higher compared to NC-PTSA (4.81 m^2 g^{-1}). The functional groups and morphology of the free and immobilized CRL were further determined by Fourier transformed infrared (FTIR) and scanning electron microscopy (SEM). These findings revealed that the immobilized CRL onto NCs and NADES1a as green materials and solvent , respectively had higher lipase immobilization efficiency and stability for the treatment of food contaminants in oils in order to satisfy increasing commercial demands in the oil industry. © 2022

Author keywords

Biocatalysis; Candida Rugosa lipase; Green solvent ; Nanotechnology; Oil industry

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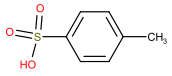

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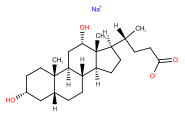

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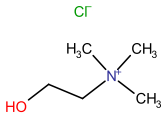

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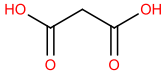

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