Kinetics study of microwave-assisted brine extraction of lipid from the microalgae Nannochloropsis sp.

ABSTRACT

The kinetics of lipid extraction utilizing microwave-assisted extraction (MAE) from Nannochloropsis sp. microalgae were studied using a low cost and green solvent, namely brine (NaCl) solution. The kinetic modelling of the lipid extraction was performed to evaluate the mechanism of the lipid mass transfer using different extraction models, including Fick's Law, First and Second-order Rate Law and the Patricelli mathematical model. The Patricelli mathematical model described the kinetics of lipid extraction well, with the highest average values of determination coefficient ($R2 \geq 0.952$) and the lowest average values of mean relative percentage deviation (MRPD $\leq$ 8.666%). The lipid analysis indicated a positive influence of the microwave temperature and time on the quantity and quality of extracted lipids. SEM analysis of spent microalgae clearly shows an increase in the distorted cell with increase microwave temperature and time, which could be directly correlated to the mechanism of the MAE-brine technique.

Keyword: Microwave-assisted extraction; Brine; Kinetics; Lipid; Microalgae; Polyunsaturated fatty acids