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Hydrothermal Conditioning of Oleaginous Yeast Cells to Enable Recovery of Lipids as Potential Drop-in Fuel Precursors

Background/Objective

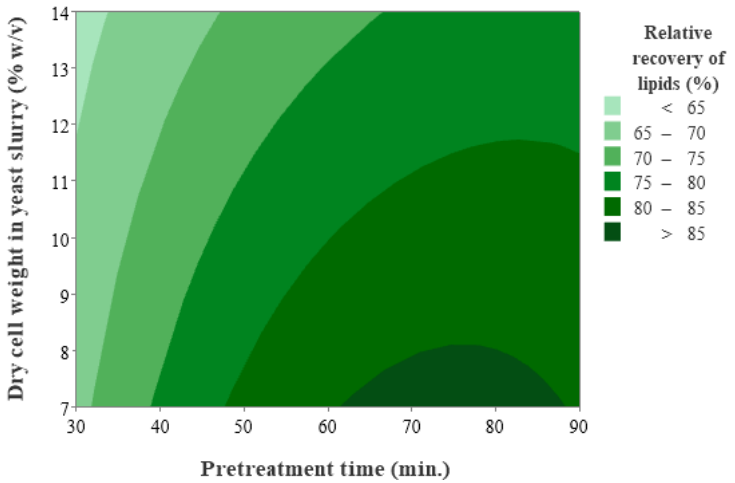
Microbial lipids produced using oleaginous yeast cells are an emerging feedstock for manufacturing commercially valuable oleochemicals, including lipid-derived biofuels, through a multistep procedure requiring yeast cultivation, harvest, lipid recovery, and lipid conversion to biofuels. The yeast's rigid cell walls resist lysis, making recovery of the total intracellular lipids challenging. Existing recovery methods include mechanical, chemical, biological, or thermochemical lysis of cell walls followed by solvent extraction. In this study, hydrothermal pretreatment was explored as a method for lysing the cell wall of the oleaginous yeast *Rhodotorula toruloides* for lipid recovery.

Approach

A slurry of *R. toruloides* Y-6987 was subjected to hydrothermal pretreatment (121°C) for various time durations and dry cell concentrations, followed by centrifugation. These pretreatments were compared with others, including sonication and acid-assisted hydrothermal pretreatments. The extracted lipids were quantified gravimetrically, and the fatty acid profile was analyzed using gas chromatography.

Results

The cell conditioning method significantly impacted lipid yield. Hydrothermal pretreatment (60 min, 121 °C, 7% w/v) with organic solvent extraction yielded ~84% (w/w) of the total lipids, while only ~20% (w/w) of the lipids could be recovered without using an organic solvent. Each method yielded a similar fatty acid profile, suggesting that the hydrothermal pretreatment did not degrade the lipids.



The optimal conditions for lipid recovery from *R. toruloides* using hydrothermal pretreatment are shown in dark green.

Significance/Impacts

The described hydrothermal pretreatment was demonstrated as a promising cell conditioning method for microbial lipid extraction, with high yields and milder chemicals, and provides a baseline for further scale-up and process integration studies.

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