FT-NIR – A tool for rapid intracellular lipid quantification in oleaginous yeast

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Lipid extraction for quantification of fat content in oleaginous yeasts often requires strong acids and harmful organic solvents, it is laborious and time consuming. Therefore, in most cases just end-point measurements of lipid accumulation are performed and kinetics of intracellular lipid accumulation is difficult to follow. To address this, we created a prediction model using Fourier Transform Near Infrared (FT- NIR) spectroscopy. This method allows to measure lipid content in yeast.

The FT-NIR calibration sets were constructed from spectra of freeze-dried cells of the oleaginous yeasts *Rhodotorula toruloides* CBS 14, *Lipomyces starkeyi* CBS 1807 and *Yarrowia lipolytica* CBS 6114. The yeast cells were obtained from different cultivation conditions. Freeze dried cell pellets were scanned using FT-NIR in the Multi Purpose Analyser (MPA) from Bruker. The obtained spectra were assigned corresponding to total fat content, obtained from lipid extraction using a modified Folch method. Quantification models using Partial Least Squares (PLS) regression were built and the calibration sets were validated on independently cultivated samples.

The R2 of the FT-NIR model for *R. toruloides* was 98%, and the Root Mean Square Error of Cross Validation (RMSECV) was 1.53. The model was validated using a separate set of R. toruloides samples with a Root Mean Square Error of Prediction (RMSEP) of 3.21. The R2 of the *Lipomyces model* was 96%, with RMSECV 2.4 and RMSEP 3.8. The models were verified by predicting the total fat content in newly cultivated and freeze-dried samples.

Using FT-NIR spectroscopy we have developed a faster, less laborious and non- destructive quantification of yeast intracellular lipid content compared to methods using lipid extraction.