Rapid determination of bulk microalgal biochemical composition by Fourier-transform Infrared Spectroscopy

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Rapid determination of bulk microalgal biochemical composition by Fourier-transform Infrared Spectroscopy

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Abstract

Analysis of bulk biochemical composition is key in fundamental and applied studies of microalgae and is essential to understanding responses to different cultivation scenarios. Traditional biochemical methods for the quantification of lipids, carbohydrates and proteins are often time-consuming, often involve hazardous reagents, require significant amounts of biomass and are highly dependent on practitioner proficiency. This study presents a rapid and non-destructive method, utilising Fourier-Transform Infrared (FTIR) spectroscopy for the simultaneous determination of lipid, protein and carbohydrate content in microalgal biomass. A simple univariate regression was applied to sets of reference microalgal spectra of known composition and recognised IR peak integrals. A robust single-species model was constructed, with coefficients of determination $r^2 > 0.95$, high predictive accuracy and relative errors below 5%. The applicability of this methodology is demonstrated by monitoring the time-resolved changes in biochemical composition of the marine alga *Nannochloropsis* sp. grown to nitrogen starvation.

Key Words: FTIR Spectroscopy, Microalgae, Lipids, Process monitoring, *Nannochloropsis* sp.