World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:19, No:03, 2025

A Multi-Omic Assessment of Biomass and Pigment Accumulation in Nitrogen Deplete Conditions in Scenedesmus 46B-D3

Authors : Galen Dennis, Lukas Dahlin, Michael Guarnieri, Stefanie Van Wychen, Shawn Starkenburg, Matthew Posewitz, Colin Kruse

Abstract : Scenedesmus 46B-D3 was identified in 2021 by screening a culture collection produced by the Posewitz lab at the Colorado School of Mines. The strain was found to continue accumulating biomass in a nitrogen-depleted state, which is a rare and technologically promising trait in microalgae. As the culture grows, a shift from nitrogen-replete to depleted conditions is indicated by arrested cell division and the accumulation of lipids, polysaccharides and photoprotective pigments. The latter trait gives stationary phase cultures a deep red color due to the presence of the high-value beta-ketocarotenoids, canthaxanthin and astaxanthin. The combination of continued photosynthesis post-nitrogen depletion and the accumulation of valuable pigments makes S. 46B-D3 of interest from a fundamental and industrial perspective, respectively. This project reports the results of a multi-omic study examining changes in the proteome and transcriptome in nitrogen-replete and deplete conditions. In addition, it characterizes the pigment composition of S. 46B-D3 across its growth curve and the method of cell division within the strain. These results indicate that upon sensing nitrogen scarcity, S. 46B-D3 efficiently recycles and repurposes nitrogen away from cell division and towards energy storage through the accumulation of lipids and polysaccharides. The accumulation of photoprotective pigments also prevents damage to and serves as an additional carbon sink for the cell's light system.

Keywords : pigments, photosynthesis, proteomics, transcriptomics
Conference Title : ICABB 2025 : International Conference on Algae Biotechnology and Biofuels
Conference Location : Sydney, Australia
Conference Dates : March 24-25, 2025