Enhancing the sustainability of microalgae biomass generation for production of alpha-linolenic acid via integration of reverse osmosis (RO) reject streams

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Industrial reverse osmosis (RO) reject streams are a significant source of pollution in surface water bodies and requires effective treatment. Microalgae-based treatment of RO reject streams is an interesting approach as it generates valuable biomass concurrent to bioremediation. This approach also enhances the sustainability of microalgae biomass production by eliminating the requirement of external nutrient supply and reducing the freshwater footprint. However, there is a significant gap in research on utilization of RO reject streams generated by food/pharmaceutical industries for synthesis of microalgae-based high-value bioproducts. The current study was performed to ascertain the potential of using RO reject streams from the local food (RO1) and pharmaceutical (RO2) industries to cultivate *Desmodesmus* sp. for synthesis of alpha-linolenic acid. Accordingly, a screening experiment was conducted by growth of *Desmodesmus* sp. in RO1 and RO2 under dilutions of 25%, 50%, 75% and 100% (undiluted sample). Results showed that the highest biomass yields were obtained in 100% RO1 and 100% RO2. Thereafter, *Desmodesmus* sp. was cultured in 100% RO1 and 100% RO2 using photobioreactors with Modified Bold's Basal media (3N-BBM) used as the control. Results showed that the use of RO reject streams resulted in a positive effect on the growth and biochemical composition of *Desmodesmus* sp. The high lipid content in biomass showcased that the use of RO reject streams could enhance the sustainability of microalgae-based alpha-linolenic acid production. However, further research is needed to study the toxicology effects and assess the techno-economic feasibility of using RO reject as the growth media.

Keywords: Reverse osmosis (RO) reject, *Desmodesmus* sp., microalgae cultivation, alpha-linolenic acid, freshwater footprint