Integration of food industry wastewater for cultivation of *Desmodesmus* sp. to synthesize alpha-linolenic acid

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Microalgae biomass production for food and fuel applications necessitates the use of resources such as water and nutrients, raising sustainability concerns. This study aimed to integrate food industry wastewaters as a source of nutrients and water for microalgae cultivation while simultaneously performing bioremediation. Nonetheless, wastewater-based microalgae cultivation requires the identification of suitable wastewater streams, nutrient loads, and appropriate media sterilization methods to prevent culture failure due to contamination. In the current study, the microalga *Desmodesmus* sp. was cultivated in wastewater-based media for synthesis of the nutritionally-valuable alpha-linolenic acid. This study is the first in literature wherein a comparative assessment was performed between autoclaving and filtration as methods for wastewater sterilization.

A screening experiment for *Desmodesmus* sp. growth was performed using brewery wastewater (BrW), coconut processing industry wastewater (CW) and biscuit wastewater (BiW) obtained from the food industry, under 25%, 50%, 75%, and 100% (undiluted) concentrations. Undiluted BiW was the most suitable media, as it resulted in the highest final biomass yields. Thereafter, undiluted BiW sterilized by autoclaving and filtration was used to culture *Desmodesmus* sp. in photobioreactors with Modified Bold's Basal Media used as the control. BiW showed higher biomass yields and specific growth rate compared to the control. A higher lipid productivity of 16.78 mg L^{-1} d^{-1} was exhibited in autoclaved medium as compared to 9.92 mg L^{-1} d^{-1} in the filtered medium. Thus, BiW sterilized via autoclaving was identified as a promising growth medium for alpha linolenic acid production from a circular economic perspective.

Keywords: Food industry wastewater, *Desmodesmus* sp., microalgae cultivation, alpha-linolenic acid, sterilization