

Influence of acid pre-treatment on microalgal biomass for bioethanol production

ABSTRACT

The utilisation of microalgal biomass as feedstock for bioethanol production has been very promising owing to the large amounts of carbohydrates embedded in the physiology of the microalgal cell. This is coupled with the potential of microalgae to achieve targets required for high growth rate bioethanol production, climate change mitigation and economic growth. The high content of complex carbohydrates entrapped in the cell wall of the microalgae makes it essential to incorporate a pre-treatment stage to release and convert these complex carbohydrates into simple sugars prior to the fermentation process. Hence, this study explores the influence of acid exposure as a microalgal pre-treatment strategy for bioethanol production. Different parameters were investigated: acid concentration, temperature, microalgae loading and pre-treatment time. A central composite design technique was employed to optimize the acid pre-treatment conditions. Results showed that the highest bioethanol concentration obtained was 7.20 g/L and this was achieved when the pre-treatment step was performed with 15 g/L of microalgae at 140 °C using 1% (v/v) of sulphuric acid for 30 min. In terms of ethanol yield, ~52 wt% (g ethanol/g microalgae) maximum was obtained using 10 g/L of microalgae and 3% (v/v) of sulphuric acid under 160 °C for 15 min. The statistical analysis revealed amongst the parameters investigated that temperature is the most critical factor during acid pre-treatment of microalgae for bioethanol production.

Keyword: Microalgae; Biomass; Acid pre-treatment; Fermentation; Bioethanol