

Studies of Lactose Utilization in Microalgal Isolate for Further Use in Dairy By-Product Bioconversion

Authors : Sergejs Kolesovs, Armands Vigants

Abstract : The use of dairy industry by-products and wastewater as a cheap substrate for microalgal growth is gaining recognition. However, the mechanisms of lactose utilization remain understudied, limiting the potential of successful microalgal biomass production using various dairy by-products, such as whey and permeate. The necessity for microalgae to produce a specific enzyme, β -galactosidase, requires the selection of suitable strains. This study focuses on a freshwater microalgal isolate's ability to grow on a semi-synthetic medium supplemented with lactose. After 10 days of agitated cultivation, an axenic microalgal isolate achieved significantly higher biomass production under mixotrophic growth conditions (0.86 ± 0.07 g/L, dry weight) than heterotrophic growth (0.46 ± 0.04 g/L). Moreover, mixotrophic cultivation had significantly higher biomass production compared to photoautotrophic growth (0.67 ± 0.05 g/L). The activity of β -galactosidase was detected in both supernatant and microalgal biomass under mixotrophic and heterotrophic growth conditions, showing the potential of extracellular and intracellular mechanisms of enzyme production. However, the main limiting factor in this study was the increase of pH values during the cultivation, significantly reducing the activity of the β -galactosidase enzyme after 3rd day of cultivation. It highlights the need for stricter control of growth parameters to ensure the enzyme's activity. Further research will assess the isolate's suitability for dairy by-product bioconversion and biomass composition.

Keywords : microalgae, lactose, whey, permeate, beta-galactosidase, mixotrophy, heterotrophy

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