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Effect of Ca^{2+} concentration on *Scenedesmus* sp. growth in heterotrophic and photoautotrophic cultivation

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Highlights

- Increasing Ca^{2+} concentration negatively affects *Scenedesmus* sp. autotrophic growth
- Increasing Ca^{2+} concentration can enhance growth in presence of olive mill wastewater
- Negative effect of Ca^{2+} can be imputed to phosphate precipitation
- Phenol adsorption can explain enhanced growth with increasing Ca^{2+} concentration
- High Ca^{2+} concentration induces *Scenedesmus* sp. cell aggregation

Abstract

The influence of Ca^{2+} concentration on the growth of the microalga *Scenedesmus* sp. in heterotrophic and photoautotrophic cultivations was investigated. Heterotrophic growth was induced by the addition of olive mill wastewaters (9% $v \cdot v^{-1}$) to the culture. Variations in the calcium concentration affected differently biomass production depending on whether microalgae were cultivated under heterotrophic or photoautotrophic regime. In photoautotrophic regime, increasing the calcium concentration from 20 to 230 mg/L decreased maximum cell concentration and growth rate. In heterotrophic cultivation, cell concentration and growth rate decreased with Ca^{2+} concentration increasing from 20 to 80 mg/L but then increased with Ca^{2+} concentration increasing to 230 mg/L. Increasing calcium concentration invariably promoted cell aggregation. The precipitation of calcium phosphates can explain the decreasing growth rate and cell concentration attained with increasing calcium concentration, while the influence of Ca^{2+} concentration on the adsorption of phenols on suspended solids can explain the enhanced growth attained at large Ca^{2+} concentration under heterotrophic regime. Implications of the illustrated results for industrial scale application of microalgae are thoroughly discussed.

Keywords

Microalgae, *Scenedesmus* sp., Calcium, Olive mill wastewater, Heterotrophic growth

1. Introduction

Microalgae are photosynthetic microorganisms that can be cultivated by application of inexpensive and renewable resources such as sunlight, CO_2, mineral salts and wastewaters. Compared to the cultivation of terrestrial plants, microalgal cultivations can ensure larger productivities per unit area, do not require arable lands and can reduce water consumption [1–3]. The ability of