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Nannochloropsis oceanica harvested using electrocoagulation with alternative electrodes – An innovative approach on potential biomass applications

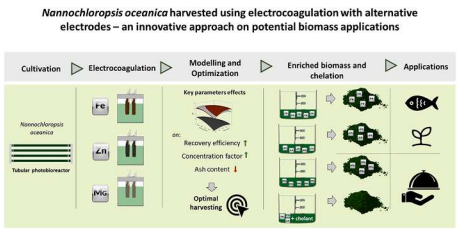
Daniel Figueiredo [a], Alice Ferreira [b], Pedro Quelhas [c], Peter S.C. Schulze [a], Luisa Gouveia [a,b,*]

[a] GreenCoLab, Green Ocean Technologies and Products Collaborative Laboratory, University of Algarve, Campus de Gambelas, 8005-139 Faro, Portugal
[b] LNEG, National Laboratory of Energy and Geology I.P., Bioenergy and Biorefineries Unit, Estrada do Paço do Lumiar 22, 1649-038 Lisbon, Portugal
[c] Allmicroalgae Natural Products S.A., R&D Department, Rua 25 de Abril 19, 2445-287 Pataias, Portugal

HIGHLIGHTS

- Electrocoagulation with Fe, Zn, and Mg electrodes recovers > 95% biomass from cultures.
- Metal-enriched biomass may be a bioresource for food, feed or agricultural markets.
- EDTA in the electrocoagulation concentrate removes Fe, and Zn from the biomass.
- Chelated metals dissolved in the liquid fraction could be re-used to cultivate algae.

GRAPHICAL ABSTRACT



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ABSTRACT

Electrocoagulation is a promising technology to harvest microalgal biomass. However, the commonly used aluminum electrodes release undesired salts that decrease biomass value. In this study, alternative iron, zinc, and magnesium electrodes and operational parameters pH, time and current density were studied to harvest *Nannochloropsis oceanica*. For recovery efficiency and concentration factor the initial pH was most important using iron electrodes, while time and current density were more relevant using zinc and magnesium electrodes. Optimal parameters resulted in biomass recovery efficiencies > 95%, biomass was concentrated 2.8–7.2 times and contained 15.7–29.1% ashes. Elemental analysis revealed metal salts in harvested biomass resulting from electrode corrosion. Finally, ash contents could be reduced by 65% using EDTA as a chelating agent. The electrocoagulation harvested microalgal biomass enriched in essential metals may be a promising bioresource for agricultural growth inducers, or functional ingredients for feed.

1. Introduction

Microalgae are a promising bioresource with a wide range of applications including food, feed, pharmaceuticals, cosmetics, wastewater treatment, biofertilizers and bioplastics (Ferreira et al., 2019). Industrial phototrophic microalgal strains achieve significantly higher biomass productivities per area than any terrestrial crop but today's algal cultures only achieve low biomass concentration (<10 g/L) and large amounts of (sea-) water must be processed (Rajesh Banu et al., 2020). This results in high costs for labor, electricity and facilities, which

* Corresponding author.
E-mail address: luisa.gouveia@lneg.pt (L. Gouveia).

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