PHD RESEARCH PROPOSAL

Doutoramento em Engenharia da Refinação, Petroquímica e Química (EngIQ)

OPTIMIZATION OF FORMULATION AND RECYCLING STRATEGIES FOR INDUSTRIAL ALGAL CULTURE MEDIA USING ICP-OES

Summary

There has been growing interest in the production of algae and microalgae due to their versatility and wide range of biotechnological applications, spanning from the production of food and nutritional supplements to the generation of biofuels and wastewater treatment.

The growth and metabolism of microalgae are strongly influenced by the composition of the culture medium, with the availability of mineral nutrients being a critical factor in biomass production and the synthesis of target products. A major challenge impacting the economic viability and environmental sustainability of large-scale production is the substantial water and nutrient consumption. This can be significantly reduced by recycling the spent media; however, the process requires precise adjustment of supplementation, thereby preventing deficiencies or toxic excesses that negatively impact algal growth.

The elemental analysis of algal culture media presents specific challenges. The complexity of the formulations and the wide range of elemental concentrations (from major to ultra-trace) require analytical techniques with high sensitivity and robustness.

Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) is a robust and precise technique for the determination of trace elements in various matrices. However, its application requires the development and validation of robust and efficient analytical methods.

The main goal of this work is to maximize the biomass productivity and efficiency of industrial algae production systems by developing and implementing both optimized media formulations and efficient recirculation strategies, all guided by precise ICP-OES elemental analysis, in order to minimize operational costs and environmental impact.