**A study on microalgal biomass harvesting by flocculation and centrifugation**

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The production of microalgal biomass involves three main stages: cultivation, harvesting and processing. Among these, the harvesting stage is crucial because the cost of this process can account for up to 20-30% of the total production cost. Various harvesting techniques have been developed, both biological and non-biological, such as filtration, centrifugation, flocculation, sedimentation and flotation, with the possibility of combining multiple methods to improve efficiency. The choice of the most appropriate harvesting method depends on the species of microalgae cultivated, the concentration and the size of the cells, the conditions of the final product and the potential for reuse of the growth medium. Coagulation/flocculation represent the most used technique to improve the economic efficiency of microalgae harvesting. This process involves the coalescence of single particles in suspension into larger flocs, that quickly settle. In this study, sedimentation analyses were conducted in 100 mL graduated cylinders, each containing *Chlorella vulgaris* cultivated in a 7 L column photobioreactor until a final concentration of 2.5 gDB/L. For each test, two parallel analyses were performed: one cylinder containing only algae and another containing *C. vulgaris* with flocculant. The tests were allowed to settle for 15 minutes, after which the sediment volume and the supernatant concentration were measured for each cylinder. The flocculants chosen for the tests were chitosan, chitosan and alginate, potato starch and calcium carbonate. To evaluate the effectiveness of the tested flocculants, sedimentation efficiency (%) and biomass recovery (%) were calculated. Moreover, batch centrifugation analyses were conducted on *Chlorella sorokiniana* and *C. vulgaris*. The two Chlorella species were diluted to reach a concentration of 1 gDB/L and placed in 50 mL Falcon tubes. The tests were conducted at 500, 1000, 2000 and 5000 rpm, both on untreated and on treated microalgae with a flocculant for 30, 60, 120 and 300 seconds. Once centrifugation was completed, the Falcon tube was removed from the centrifuge and 2 mL of supernatant were taken to measure its concentration using a spectrophotometer. Results were produced by correlating centrifugation time with centrifugation efficiency (%). The biomass collection procedure has been optimized through the use of a chitosan and alginate flocculant, which has allowed for the harvesting of over 90% of the algae using the sedimentation process. This same flocculant, when tested in a centrifuge, enabled effective separation in shorter times and at low speeds, resulting in considerable energy and cost savings.

**Keywords**: *Flocculation, Centrifugation, Microalgae harvesting, Chitosan, Alginate*