

Pre-concentration of *Chlorella vulgaris* by electrocoagulation

Ing. Irena Brányiková, Ph.D.

Institute of Chemical Process Fundamentals of the Czech Academy of Sciences
Department of multiphase reactors, Praha 6 - Suchbát, Czech Republic

Harvesting densities of microalgae suspensions in industrial cultivation devices are very low, most often in the range between 0.5 and 3 g/L of dry biomass. Nevertheless the biomass concentration suitable for drying (the most usual biomass processing) are around 150 g/l. It is well known that microalgae like e.g. *Chlorella*, which has small cells, are impossible to be separated from the cultivation media by low cost methods as sedimentation or filtration. They are usually separated by energetically demanding centrifugation, which energy cost was estimated to be around 2 kWh/kg of dry biomass. The microalgae cells have negative surface charge, so they repulse each other by electrostatic forces and because of that form stable suspension. To destabilize the suspension it is possible to apply a process of coagulation (flocculation) when flocculating agent is added and cell aggregates (precipitates) are formed. Flocculating agent is suitable chemical compound, which has positive surface charge and enables crosslinking between negatively charged microalgae cells. Unfortunately to find a flocculating agent, which is effective and food-grade in the same time, is almost impracticable. To overcome this difficulty, we employed electrocoagulation (EC) with iron electrodes in order to destabilise a microalgae suspension and form aggregates, which can be easily separated by sedimentation. During EC, iron cations are released from the sacrificial anode and acts as the flocculating agent. When process parameters are set optimally, separated microalgae biomass contains very low amount of this biogenic element and remains suitable for human consumption. We studied the EC of *Chlorella* first in laboratory scale with subsequent scale-up to pilot continuous EC device. We were able to separate *Chlorella vulgaris* from suspension with 98% efficiency and decrease the biomass separation costs to 0.15 kWh/kg, which was 7.5 % of the energy consumed by solely centrifugation.