Starch production by freshwater microalgae in heterotrophic dark fermentation

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Microalgae were identified as third generation biomasses for biofuel production due to the high yield of biomass and lipid content. Nevertheless, even promising laboratory scale data fail to satisfy economic feasibility of large scale productions due to the high costs of cultivation plants and downstream operations. Dark fermentation using wastewaters as organic source could be a sustainable solution to such drawbacks allowing the reduction of both plant and operating costs. In the same view, the biorefinery approach could also sustain economic feasibility by exploitation of different biological fractions in microalgae. In fact, these biomasses are rich of lipids but also of proteins, carbohydrates, and some other very interesting fine chemicals (such as carotenoids).
In this view, BioP started a project aiming at the design and construction of a prototype unit including cultivation and downstream for the recovery of starch and fine chemicals from microalgae. A two-stage process including phototrophic cultivation as pre-cultivation stage and dark fermentation as productive phase was conceived. Phototrophic section includes 10 tubular photo bioreactors equipped with pH and temperature automatic control. Several species will be cultivated both alone and together to identify the best cultural conditions to proceed towards dark fermentation phase using wastewaters as source of carbon. In this phase, cultures grow in presence of organic carbon, silencing photosynthesis and accumulating intracellular starch granules. Downstream operations will aim at recovering purified starch for biopolymer production and recovering other valuable fractions such as lipid one, rich of carotenoids. To this aim, both conventional organic solvents and ionic liquids will be used.