

Microalgae exploitation under an approach of circular economy

Microalgae are a class of photosynthetic microorganisms that aroused interest in the scientific community over the last twenty years. Thanks to their wide variety of species, they may be employed in several fields according to the characteristics of the produced biomass. Microalgae accumulate high-value compounds, such as carotenoids and omega 3. These compounds find application in the nutraceutical, pharmaceuticals and aquaculture fields and own an attractive commercial value. The remaining fractions of algal biomass are composed of lipids, carbohydrates and proteins and may be exploited in several other applications. For example, the protein fraction may be used as a biostimulant, the carbohydrate fraction may be employed as a source of fermentable sugars or furfural compounds, and the lipid fraction may be used as a source of biodiesel or as feedstock for biocatalytic processes. Furthermore, microalgae can use CO₂ as a carbon source and grow in wastewater using inorganic compounds such as nitrates and phosphates as nutrients. For this reason, they may be used in wastewater treatment with excellent results. They can also treat emerging contaminants and decrease the metals from the waters in which they grow. In the last years, the scientific community defined the concept of biorefinery applied to microalgal biomass. However, the processes of cultivation, harvesting and downstream treatment of the biomass require a significant energetic expense. It is, therefore, necessary to exploit every fraction of the obtained biomass to make the entire operation economically feasible and fulfil a circular process.