Selection, cultivation and innovative applications of microalgae from the SCCA culture collection

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Algae are a polyphyletic, artificial assemblage of O_2-evolving, photosynthetic organisms ubiquitous in marine, freshwater and terrestrial habitats and possessing broad biochemical diversity. The implied biochemical diversity is the basis for several biotechnological and industrial applications. The importance of biodiversity and the need to conserve the earth's genetic resources is today widely accepted. Furthermore, the ecological, scientific, commercial importance and future potential of micro-organisms has stimulated considerable political and scientific dialogue. The production of biofuels from renewable feedstock is recognized to be critical to fulfill a sustainable economy and face global climate changes. When compared to first-generation biofuel feedstock, microalgae are characterized by higher growth rates and lipid content which result in larger bio-oil productivities. Moreover, cultivation of microalgae can be carried out in less- and lower-quality lands, thus avoiding the exploitation of arable ones. In addition, cultivation of microalgae could be coupled with the direct bio-capture of CO_2 emitted by industrial activities that use fossil fuels for energy generation. The Mediterranean basin is usually considered to be quite rich in terms of biological diversity. In particular Sardinia represents a biodiversity hotspot. The primary mission of the Sardinian Culture Collection of Algae (SCCA) is the isolation, identification, selection and in vitro cultivation of photosynthetic microorganisms from different Sardinian habitats. In addition, the use of algae for environmental restoration, biotechnology and alternative sources of energy, are being investigated. The algal collection SCCA available at CINSA (University of Cagliari) is constituted by over 100 microalgal authentic strains, i.e. cultures derived from the original type material. It is intended that the strains in this collection can provide a source of extremely useful material for laboratory experimentation and for mass culture research. Some genera such as *Chlorella*, *Coccomyxa* and *Tetraspora*, have been chosen for possible biotechnological production of high value products such as omega-3, vitamins, pigments with antioxidant characteristics, functional foods, fertilizers and/or fodder and diverse precursors to be sold in different strategic markets like nutraceutical, biomedical, cosmetics and food markets. The innovative microalgae technology for production of high added value bioproducts, combined with the contextual uptake of CO_2 from exhaust gas, and the purification of urban waste water, in the context of an agro- bio-industrial refinery, would have significant effects on the environment, with also potentially large impact on employment. The objective of this research is therefore to develop one or more technologies based on Sardinian microalgae, for the production of high value added compounds, optimized by the techno-economic point of view and therefore characterized by high scalability.