BIOLEAP - Biotechnological optimization of light use efficiency in algae photobioreactors

New renewable energy source are highly needed to compensate exhausting fossil fuels reserves and reduce greenhouse gases emissions. Some species of algae have an interesting potential as feedstock for the production of biodiesel thanks to their ability to accumulate large amount of lipids. Strong research efforts are however needed to fulfil this potential and address many issues involving optimization of cultivation systems, biomass harvesting and algae genetic improvement. This proposal aims to address one of these issues, the optimization of algae light use efficiency. Light, in fact, provides the energy supporting algae growth and must be exploited with the highest possible efficiency to achieve sufficient productivity.
In a photobioreactor algae are highly concentrated and this cause a inhomogeneous light distribution with a large fraction of the cells exposed to very low light or even in the dark. Algae are also actively mixed and they can abruptly move from dark to full illumination and vice versa. This proposal aims to assess how alternation of dark/light cycles affect algae growth and functionality of photosynthetic apparatus both in batch and continuous cultures. In collaboration with the Chemical Engineering department, experimental data will be exploited to build a model describing the photobioreactor, a fundamental tool to improve its design.
The other main scope of this proposal is the isolation of genetically improved strains more suitable to the artificial environment of a photobioreactor. A first part of the work of setting up protocols for transformation will be followed by a second phase for generation and selection of mutants with altered photosynthetic performances. Transcriptome analyses in different light conditions will also be instrumental to identify genes to be targeted by genetic engineering.

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