Abstracts & Program

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ABSTRACTS

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Out-door mass cultivation of *Nannochloropsis* in annular reactors

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Nannochloropsis is a marine microalga commonly cultivated in the hatcheries as feed for rotifers and for fish larvae rearing. Mass production of *Nannochloropsis* requires the adoption of closed photobioreactors, since open ponds do not ensure a long-term reliable cultivation (7). In the hatcheries, the cultivation of *Nannochloropsis* is currently carried out in polyethylene bags or transparent fiberglass cylinders (5), prevalently under artificial illumination. At the experimental level, in the laboratory or in pilot plants, more efficient, high surface-to-volume ratio photobioreactors (panels, tubular and annular reactors) have been successfully used for cultivation of *Nannochloropsis* under artificial (2, 9), natural (1, 8) or combined illumination (3).
A 1200-L plant made of ten 50-cm annular reactors was set up at the University of Florence in September 1998 and was operated for two years under combined illumination from autumn to spring, when *Nannochloropsis* biomass is required by the hatcheries. The production of the plant was on average 270 g of dry *Nannochloropsis* biomass per day. The cost of artificial illumination was estimated to be about 35 € per kg dry biomass. Recently, it has been shown that *Nannochloropsis* can be preserved at low positive temperature (4). This achievement makes it possible the production of the biomass during the summer, using the sole natural light and its storage until the period of use in the hatcheries.
In this work, the outdoor cultivation of *Nannochloropsis* sp. during the summer in annular reactors was investigated. The microalga was grown from May to August 2003 in five 120-L annular reactors (3). The influence of season and dilution rate on productivity, biochemical composition, specific growth rate and cell mass was evaluated. During July, a 50% daily harvest regimen proved to be optimal, giving a mean productivity of 55.4 g reactor^{-1} d^{-1} (0.48 g l^{-1} d^{-1}). The productivity decreased to less than 30 g reactor^{-1} d^{-1} at the lowest harvest regimen adopted (10%). Variation of the biochemical composition as affected by season and dilution rate are discussed.
Compared to other culture systems used to cultivate *Nannochloropsis* outdoors (open ponds, near-horizontal tubular reactors and vertical panels) the annular reactor allows to achieve significantly higher efficiencies of sunlight conversion. The reasons of the better performance of this system are discussed.
This study indicates that the annular reactor can be profitably used for outdoor cultivation of *Nannochloropsis* during the summer avoiding the problems observed in previous experiments (1, 6) and achieving significantly higher productivities than under artificial or combined illumination.