Understanding the bioflocculation potential of wastewater native filamentous cyanobacteria

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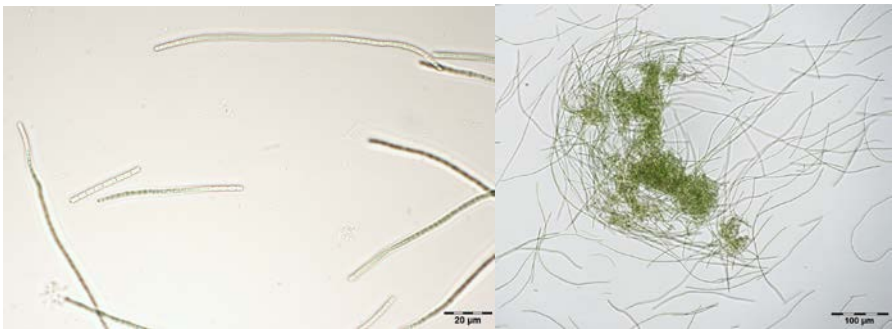
Wastewater as low-cost medium for growth of microalgae and cyanobacteria is now well established. The major obstacle for large scale applications is represented by the biomass harvesting, accounting for 20–30% of the total costs of microalgal biomass cultivation. Principal solutions for harvesting are centrifugation and flocculation but cannot be applied at large scale. Indeed, centrifugation is a high energy consuming process and chemical flocculation leads to the secondary pollution of the liquid effluent. Recently, researches focused on filamentous algae for a cheaper biomass harvesting. The results were promising but these algae are not adapted to wastewater. Starting from these observations, the present work studied the bioflocculation of wastewater native microorganisms which, potentially, is very promising for industrial applications.

The inoculum has been collected in the secondary clarifier of urban wastewater plant located in Isernia (Molise) and further cultivated in generic Bold Basal Medium under controlled conditions. The dominant species identified are filamentous cyanobacteria *Pseudanabaena* sp. and *Leptolyngbya* sp. (left picture), which showed tendency of forming flocks in the culture (right picture).



The inoculum bioflocculating potential has been studied in synthetic medium by applying different initial biomass concentrations and for different physical mixing conditions (air bubbling vs oscillatory movement). These two parameters seemed to influence flocks forming ability according to previous observations.

Bioflocculation has been monitored in terms of flocculation capability. Flocks shape and dimensions have been also monitored with microscopic analysis. Settling tests have been performed and the settling velocity has been measured applying an original method based on photos acquisition and image analysis.

Results showed that initial biomass concentrations did not influence bioflocculation capability. The two cultivation systems gave different flocks shape and dimensions only before the exponential growth phase. Oscillatory movement induced bigger flocks (15 mm^2 vs 7 mm^2) possibly because of the reduced shear effects. When the same biomass concentration is reached in both systems, the flocculation resulted comparable. Best flocculation and harvesting condition has been identified at the end of the exponential growth phase for all the different initial conditions, corresponding to the highest biomass concentrations.