MAB4

Study of up- and downstream processes in *Microcystis aeruginosa* cultivation – One approach, two distinct objectives

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The cyanobacterium *Microcystis aeruginosa* and the accumulation of its cyanotoxin microcystin (MC) have been responsible for several human/animal deaths and intoxication incidents. Therefore, the

World Health Organization established recommendation values for MC in water, giving rise to an increasing demand for MC's analytical standards to be used as laboratory standards both in human and environmental risk assessment studies. These Cyanotoxins are also considered promising anticancer/antitumor drugs as well as antifungal, antialgal and insecticide agents. Despite the interest, commercial MC availability is still limited due to constraints found in production, which inflate the final price to values as high as 28000 €/mg.

Therefore, in order to implement a cost-effective MC production, the objectives of this work were the following: 1) evaluate the effect of environmental factors on *M. aeruginosa* growth and MC accumulation; 2) implement cultivation strategies (e.g. co-cultivation) to optimize cyanobacteria growth and MC productivity; 3) optimize downstream processing steps in order to increase cost-effectiveness.

The combined influence of light intensity, CO2 concentration, temperature and medium pH on *Microcystis aeruginosa* toxicity, biomass concentration and productivity was evaluated, setting the bases to explore combinations of environmental variables as a means of limiting cell growth and/or toxin production or to boost its industrial production. Higher MC concentrations were obtained at low light intensities and CO2 concentrations while approximately 1000-fold lower MC concentrations were achieved by simultaneous use of high values of light intensity, CO2 concentration and temperatures.

In order to ensure cost-effective downstream processing, six different disruption methodologies (microwave, high-speed homogenizer, sonication, freeze-thaw cycles and bead mill) and several harvesting approaches were tested. Disruption and harvesting efficiencies up to 97 % and 95 %, respectively, were attained.

This study allow us to achieve two distinct objectives: i) increase cost-effectiveness of MC production; and ii) improve controlling and predicting mechanisms regarding *M. aeruginosa* blooms.