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Valorization of Toxic Cyanobacteria Biomass - disruption efficiency assessment and consequent bioproduct availability using different disruption techniques

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Comunicación:
The worldwide occurrence of hepatotoxic cyanobacterium Microcystis aeruginosa and accumulation of its toxin microcystin-LR, have been responsible for several human deaths and animal intoxication incidents. In recognition to its toxicity, the World Health Organization and several national governments established guideline values for this toxin in water, which gave rise to an increasing demand for microcystin's analytical standards. These standards might be useful either as laboratory standards to apply in human and environmental risk assessment or as tools for molecular and cell biology studies. However, their availability is still limited due to constraints found in production and purification processes, which inflate the final price to values as high as 28000 €/mg. As an example of the increasing interest observed over the last years, U.S. Environmental Protection Agency has recently announced that cyanotoxins became part of its list of substances to be studied as a precursor to regulatory action between 2018 and 2020. Consequently, the optimization of this cyanobacterium cultivation and toxin purification techniques is needed to decrease the production cost of such high added-value product. In biotechnological industrial scale processes, the costs associated with downstream processing often represent more than 60 % of the overall expenses.
The aim of this work is therefore to provide an insight regarding the development of a cost-effective process for obtaining high-quality and affordable microcystin-LR by evaluating the efficiency of three different methodologies (microwave, freeze-thaw cycles and bead mill) on the disruption of M. aeruginosa and consequent availability of bioproducts. For that purpose, several parameters including time, power, and temperature were tested. The best conditions determined for each extraction method were the following: i) 1.5 minutes at 800 W (microwave), ii) three 12-hour cycles at -20 ºC (freeze-thaw cycles), and iii) 7 minutes using 20 % (v/v) of glass beads (bead mill). According to cell counting and intracellular organic matter release determining techniques, freeze-thaw cycles have shown to be the best disruption method presenting an overall efficiency around 97 %.