ALGAL-BACTERIAL PROCESSES FOR THE TREATMENT OF AGROINDUSTRIAL WASTEWATERS

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The high energy requirements and the operational complexity of conventional activated sludge systems for agroindustrial wastewaters treatment have hindered their widespread application in rural areas. Likewise, the implementation of anaerobic digestion, despite combining organic matter removal with biogas production, is often restricted by the poor nutrient removal, the need for a complex process control (temperature & loading rate) and the unfavourable C/N ratio of agroindustrial wastewaters.

In addition, none of the mentioned treatment methods exhibits a significant nutrient recovery potential, which represents a serious limitation in the world's quest for sustainable development. The coming scenario of high energy costs and scarcity of natural resources makes mandatory to develop sustainable processes for pollution control with a low energy consumption and the potential for resource recovery.

Therefore, the development of cost-effective and environmental friendly wastewater treatment methods is crucial to achieve a sustainable activity in agroindustrial processes.

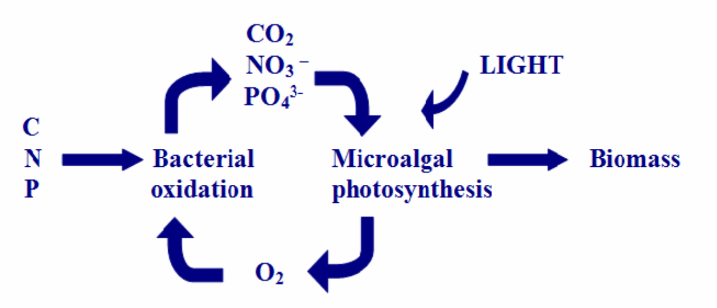

Figure 1. Cycle for photosynthetic oxygen.

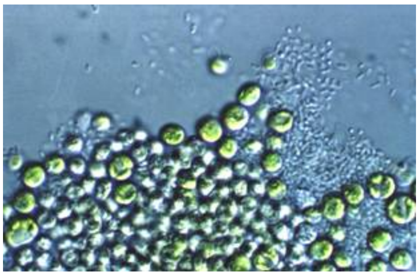

Figure 2. Algal-bacterial microcosms

Microalgae-based processes constitute a less energy intensive and more environmentally friendly alternative to conventional treatment methods due to its free O_2 production and its potential for nutrients recovery. In photosynthetically oxygenated processes, microalgae supplies the O_2 required by bacteria to oxidize both organic matter and NH_4^+, while bacterial respiration provides the CO_2 needed for microalgal photosynthesis (figure 1). This solar-powered symbiosis constitutes thus a cost free oxygenation mode. The nitrogen and phosphorus present in the wastewater is also effectively removed via assimilation into algal-bacterial biomass or via pH-enhanced NH_4^+ stripping and PO_4^{3-} precipitation. The fecal coliforms, an essential parameter in the livestock wastewaters, are removed due to the high oxygen concentration and the pH value. The simplicity of the microalgal-bacterial systems and the high rates of symbiotic growth are an alternative technically and economically viable. In addition, the potential valorization of the residual microalgal-bacterial biomass as fertilizer, as source for CH_4 production or as supplement in animal alimentation can offset a significant fraction of process operational costs. Figure 2 shows a picture of a microalgal-bacterial consortium.

This research project will assess the potential of microalgal-bacterial systems for the biodegradation (carbon and nutrients removal) and biomass production from agroindustrial wastewaters. More specifically, the symbiotic mechanisms between algae and bacteria, the elucidation of the inhibitions caused by the wastewater and the determination of the potential nutritional limitations will be investigated. In addition, the optimization of photobioreactor design and operation in order to maximize C and nutrients removal will be studied. Finally, the potential of the residual algal-bacterial biomass produced will be evaluated as biofertilizer and as a supplement for *Daphnia sp*. (figure 3) nutrition.

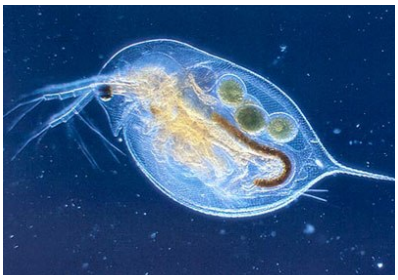

Figure 3. Daphnia s.p. is a crustacean used in aquaculture nutrition.

Relevant publications

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