Cyanophycin from Urine

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Motivation

In a world with an increasing population and consequently high demand of resources, new approaches to close material and nutrient cycles are needed. In this perspective microalgae and cyanobacteria present new possibilities.

Humane urine is a nutrient source containing 70% of the phosphorous and 40% of the nitrogen load in household wastewater. The microalgae *Chlorella sorokiniana* was successfully grown on urine and it was proposed to use the algae biomass as a fertilizer (Tuantet et al., 2014). However, Chlorella's nutrient requirements does not match the urine's high phosphorous to nitrogen ratio and due to its rigid cell wall it is difficult to extract energy or functional components from it. Also Cyanobacteria could be used for urine treatment, with the advantage that under certain stress conditions (e.g. phosphorous limitation) some species of cyanobacteria can accumulate a nitrogen rich polypeptide called cyanophycin.

The aim of this project is to grow cyanobacteria on urine and in this manner combine urine treatment with recovery of cyanophycin as a valuable product, to be used in the bio-plastic and pharmaceutical industry.

Technological challenge

Cyanobacteria accumulate nitrogen when they face stress conditions (P and/or light limitations). This nitrogen is stored in cyanophycin granules (CG).

Under certain conditions cyanobacteria vegetative cells develop a resting cell stage called akinete in which cellular structure, composition and morphology change (Figure 1).

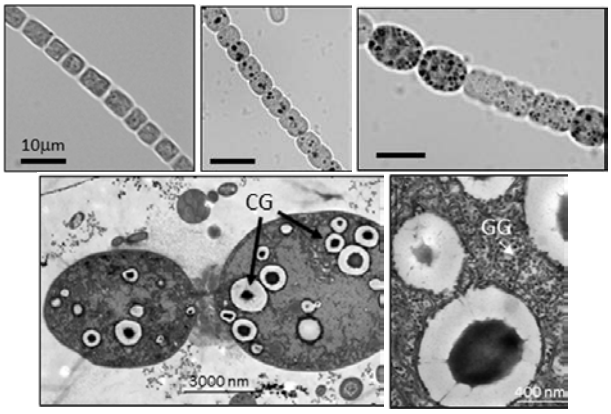

Figure 1. Akinetes development and CG. (Sukenik et al., 2015)

In the transition from vegetative cell to akinete cyanophycin accumulation is increased as well as the cell volume and the cell wall is thickened (Sukenik et al., 2015).

The technological challenge is to find conditions that trigger the production of cyanophycin in flat panel photobioreactors with several cultures of cyanobacteria, and to identify the optimal conditions to maximize cyanophycine cell content. This should be combined with efficient nutrient removal from urine.

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