Wastewater treatment using microalgae

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The discharge of secondary effluents from wastewater treatment, containing nitrogen (N) and phosphorus (P), can cause a risk of eutrophication of surface waters and seas. Microalgae have the ability to remove these nutrients simultaneously from wastewater. Besides P is becoming scarce and N more expensive to produce, which stimulates the reuse of both nutrients from wastewater. Due to the depletion of mineral phosphate reserves, the recycling of P will be necessary to guarantee the production of fertilizer for food production. The produced algal biomass contains valuable lipids, carbohydrates and proteins that can be used as source of energy, bulk chemicals and animal feed. The use of wastewater nutrients is necessary to make algal biofuel production both sustainable and economically achievable. The objective of this research is to identify the biotic and abiotic conditions that are optimal for the removal of P from wastewaters by microalgae.

Wastewaters have a variable N:P ratio therefore we examined the effect of the initial N:P ratio on algal growth, nutrient removal and biomass composition. Batch nutrient uptake experiments were performed with the alga *Chlorella vulgaris* in synthetic wastewater. This medium contained various N (10 to 50mgL^{-1}) and P (2 to 10 mgL^{-1}) concentrations. The microalgae completely removed 10 to 30mgL^{-1} N and 2 to 4mgL^{-1} P from the medium. In these treatments, the final biomass concentration was up to a factor 2 lower. The biomass molar N:P ratio ranged from 15 to 42 indicating that more N is accumulated, compared to the Redfield ratio of 16. Therefore comparative batch experiments with the alga *Scenedesmus obliquus*, where more P accumulation is expected, are performed.

Real wastewater also contains P compounds different from orthophosphate. These inorganic (e.g. sodium triphosphate, struvite) and organic (e.g. phosphate esters) P compounds are often not readily available. Therefore the bioavailability of model P compounds is being tested.