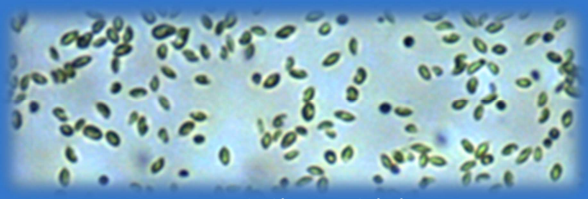
Microalgae to recover phosphorus from small-scale waste water treatment plants

Piloted by: Glasgow Caledonian University

P-source: Waste water at small-scale wwtp

P-product: Microalgae biomass containing phosphates



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The process

In small wastewater treatment plants (wwtp's), nutrients such as P are usually not recovered and therefore discharged into the environment leading to potential eutrophication problems. Recovering P from these decentralized small wwtp's requires systems offering robustness, low maintenance and adaptated to a high variability of P in wastewater. The extremophile microalgae *Chlamydomonas acidophila*, which grows at a pH of 2-3, appears to have potential for P recovery at these sites, as it has high phosphorus and nitrogen uptake rates (up to 90%) whilst operating at low temperatures.

One of the limiting factors in microalgae technology is light availability. *C. acidophila* was selected partially as this algae requires a very low light intensity to grow (40-113µmol photons $m^{-2}s^{-1}$). Additionally *C. acidophila* is able to grow and consume nutrients in the presence of pharmaceuticals 1000 times higher than the concentrations reported in effluents. Normally the presence of micropollutants such as pharmaceuticals in urban wastewater could inhibit biological treatment processes.

Furthermore, this species is mixotrophic so the presence of organic carbon in the effluent improves nutrient recovery efficiency. As a result of all these characteristics, *C. acidophila* seems to be a suitable treatment option for P recovery for small scale wwtp's, enabling the achievement of a 50-75% phosphorus recovery rate.

The product

After harvesting, the biomass of microalgae containing the recovered phosphorus can be used directly as fertilisers.

Microalgae could be a potential N and P bio-fertiliser in addition to other organic fertilizer. Furthermore, *C. acidophila* accumulates carotenoids, valuable antioxidants that could improve the crop growth.

The product could be spread on land either mixed with organic fertilizers or mixed with a liquid in drip irrigation system.

The demonstrator

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Location: Scotland, Development Centre at Bo'ness
Commissioning: September 2018
Input material: waste water at small scale wwtp
Input mass: approx. 200 PE
Output: microalgae biomass with P and N
Output mass: approx. 1-2 kg/week

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