

A sustainable biological treatment of landfill leachate for nutrients recycling and biohydrogen production

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1. Executive summary of the project

Landfill leachates are an environmental threat due to their high nitrogen content together with other elements and organic contaminants and need to be treated before releasing them in natural water bodies. The project aimed at demonstrating at pilot scale a biological process for treating landfill leachates using microalgal cultivations to recycle the nutrients into the microalgal biomass instead of letting them contribute to sea eutrophication. Experiments were performed in the laboratory and at large scale in different industrial environment using landfill leachate, dairy wastewater and even municipal wastewater. Microalgae could remove nitrogen and phosphorus from various combination of landfill leachate and different wastewater. Even the organic particulates could be removed during microalgal cultivation and subsequent harvesting. The microalgal biomass was used in the laboratory for the production of hydrogen through dark fermentation using sludge from the anaerobic digesters of the dairy and the wastewater treatment plant in the Umeå region. The microalgal biomass could successfully be fermented to produce hydrogen even though not with great efficiency. The water after cultivation has been used as a possible biofertilizer/biostimulant with very promising results as shown by the increase of barley yield.

If the processes investigated in this project were fully implemented in Sweden, 2150 tons of nitrogen would not be discharged in the Baltic Sea every year and would be used instead to grow 35800 tons of dry microalgae biomass (which would in turn fixate 71700 tons of CO₂), and from the dark fermentation of the microalgae biomass 38000 kg of biohydrogen.