



Integrated system for macroalgae production and conversion into biogas

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Recently research on energy from macroalgae is being reconsidered driven by the following factors: fuel price increase, CO₂ mitigation policies and interest on renewable energy sources after the Kyoto protocol, and need for energy crops not competing with land for food production. However, the commercial expansion of this energy source is limited by its economic feasibility. In this presentation we analyse the development of integrated systems that promote synergies between macroalgae/biogas production and activities such as aquaculture and urban wastewater treatment. The recycling of nutrients and CO₂ by macroalgae can be an opportunity to reduce the biomass-biogas production cost. Other advantage is the proximity between biomass production, conversion into energy and its consumption, thus avoiding energy losses and pollution in transportation.

Experimental work is underway and includes batch tests to evaluate biodegradability of *Ulva* spp. and *Gracilaria* sp. and co-digestion of these macroalgae with sewage sludge from Beirolas wastewater treatment plant (WWTP). Furthermore, continuous co-digestion experiments are planned to be carried out in a 30 L experimental reactor to be placed in the same WWTP. The objectives are to reproduce sludge digestion in Beirolas WWTP and evaluate algae/sludge co-digestion performance.

Preliminary results indicate methane yields in accordance with similar batch experiments, whereby our CH₄ yields per volatile solids added range between 0.14-0.20 m³ CH₄ kg⁻¹ VS_{added} against 0.16-0.27 m³ CH₄ kg⁻¹ VS_{added} [1,2] depending on the algae species and pre-treatment. Overall, *Ulva* sp. shows a better performance over *Gracilaria* sp. as also confirmed in other experiments [1].

References

- [1] Habig, C., DeBusk, T. A. and Ryther, J. H., 1984. The effect of nitrogen content on methane production by the marine algae *Gracilaria tikvahiae* and *Ulva* sp. *Biomass*, 4(4): 239-251.
- [2] Nielsen, H.B. and Heiske, S., 2010. Anaerobic digestion of macroalgae: methane potentials, pretreatment, inhibition and co-digestion. 10 th IWA World Symposium on Anaerobic Digestion.