ABSTRACT

Blanco Sastre, Elisabet. STUDY OF BIOGAS PRODUCTION FROM HIGH RATE PONDS ALGAE FOR THE WASTEWATER TREATMENT. 2010. Final work of the Master of Environmental Engineering of the Polytechnic University of Catalonia (UPC).

One of the natural systems for wastewater treatment as alternative to conventional systems are the high rate ponds. It is based on creating a symbiosis between degrading bacteria and the cultures of microalgae present in the pond to provide the necessary oxygen to the ponds. This type of system produces large quantities of biomass waste (mixture of bacteria and algae). The fact that this waste is so rich in organic matter, the best management solution is energy recovery through anaerobic digestion as in the conventional WWTP.

This biomass is composed mainly of microalgae, that is main reason to subject to pretreatment, in order to break the cell membrane and thus increase the amount of organic matter available to be subsequently digestion.

This work has studied the effect of microwave pretreatment on the microalgae from the high rate ponds to observe improvements in biogas production as a result of anaerobic digestion.

Different pretreatments were performed with varying conditions of microwave power applied (200W and 450W), pretreatment time and temperature reached (50 ºC 70 ºC and 90 ºC) in a series of 6 treatments total. All tests increased the solubility of organic matter getting the best treatment 450W of power, 330 seconds and a temperature of the substrate of 99 ºC. This test managed to increase the relationship between Volatile Solid dissolved (VSD) and Total Solids dissolved (STD) regarding the control a 307%, and an increase of 160% of the relationship between soluble Chemical Oxygen Demand (CODs) and total Chemical Oxygen Demand (CODt) regarding the control.

At the same time, this treatment has been found that it has the highest values of biogas after anaerobic digestion in a batch test of 37 days. It produced 5.7 ml CH₄ / g VS with a biodegradable substrate of 32.7%.

In conclusion, the effect of a pretreatment in microalgae increases the solubilization of organic matter making it more available and improve the process of anaerobic digestion to a 122% increase biogas production compared to control.
Keywords: algae, anaerobic digestion, microwave pretreatment, solubilized organic matter, biogas.