**Biological pretreatment of sewage sludge before anaerobic digestion process**

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**Highlights**

* Anaerobic digestion process.
* Biological pretreatment of sludge.
* Biomethane potential.

**1. Introduction**

The sludge line from conventional wastewater treatment plant (WWTP) generates high amount of sludge after decanting the solids coming from primary (sedimentation) and secondary (biological) treatments. In this sense AEBIOM estimated a potential of 6 billion Nm3 of biomethane coming from sewage sludge in 2018 (Scarlat et al., 2018). Different biological pretreatments such as temperature phased digestion (TPAD) or fungi treatment are being widely studied to increase the biomethane potential in anaerobic digestion processes. These types of pretreatments are designed in order to improve the hydrolysis step in an eco-friendly way and with no special equipments (Zhen et al., 2017). In this regard, in this work a pretreatment based on fermentation using *B licheniformis* has been carried out with the aim to prepare the sludge for following anaerobic digestion step.

**2. Methods**

The inoculum was obtained from 5L single-phase dry-mesophilic AD operating at HRT = 20 d. The sludge as substrate was obtained from the aerobic digester from CENTA, in Carrión de los Céspedes (Seville, Spain). The crude and diluted (1:2 and 1:10) sludge was autoclaved (30 min 121 ºc) before fermentation with *B. licheniformis* ATCC 21415. Growing bacteria conditions were: Medium:LB, T =37 ºC, agitation rate =150 rpm, Time = 288 h.

250 ml BMP serum bottles were used in order to determine the methane potential of different pretreated samples. The digesters were initially loaded with a mixture of 40% v/v inoculum and pretreated sludge. Control reactors were also incubated. All the anaerobic digestion experiments were carried out until all the available carbonic content was converted to biogas (23 days). All reactors were run in duplicates. At the beginning and at the end of each experiment the samples were characterized in order to evaluate the biodegradability of the samples. During the experiment volume and composition of biogas produced were registered.

**3. Results and discussion**

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**Figure 1.** Initial and final CODs and Amonium in BMP experiments.

CODs the removal percentages are very similar and more than twice higher (73.4-82.7%) than control WP (38%). Fermentation pretreatment of crude and diluted substrates obtained high values of ammoniacal nitrogen with values of 0.762, 1.57 and 1.17 g NH3-N/L respectively for pretreatments 1:2F, 1:10F and F. This fact can be explained because protein degradation efficiency during fermentation pretreatments.



**Figure 2.** Accumulated biomethane production through the time for different pretreated substrates.

As it can be observed in the Figure 2, F sample need 3 days in order to adapt the inoculum to high ammonium values. In the pretreatment 1:10F there was inhibition by ammonia content because excess of that. This effect could also have happened in the 1:2F pretreated sample but, here, the organic load content was higher, increasing the C/N ratio (and thus the biogas yield).

**4. Conclusions**

Biochemical treatments tested for sewage sludge result in higher depuration efficiency in terms of CODs. Fermentation increase the biogas volume in 5.77 times respectively compared with control. The selection of optimal pre-treatment must take into account the final C/N ratio.

**5. Acknowledgment**

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**References**

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