**Effect of enzymatic pretreatments on sewage sludge anaerobic digestion.**

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**Highlights**

* Anaerobic digestion process.
* Enzymatic hydrolysis of sludge.
* Biomethane potential.

**1. Introduction**

Stabilization of sludge by anaerobic digestion is a crucial step to remove pathogens, solids and bad odours, to increase the ammonia content and to enhance the partial mineralization of organic matter. This operation has an extra value due to the biomethane potential production and hence energy saving. For this purpose, different technologies have been developed in order to increase the biomethane potential in anaerobic digestion processes. These studies are mainly focused on increasing the biodegradability of sludge by physico-chemical and/or biochemical methods, improving hydrolysis step in overall anaerobic digestion process (Yu et al., 2013). In this sense, the application of purified enzymes is recognised as an effective hydrolysis pretreatment in order to increase biodegradability of residues (Zhen et al., 2017).

**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 in Experimental WWTP in Center for Water New Technologies (CENTA) in Carrión de los Céspedes (Seville, Spain). The substrates were previously pre-treated by different enzymatic pretreatments Glucanase (G), Cellulase (C) and Protease (P), at concentration 0.3% w/w.

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.** Biodegradability parameters removal. (a) CODs and CODt ; (b) TVS and VFAs.

In general, CODt and TVS removal efficiency is in the range 10-20% and 30% respectively. However, CODs removal percentages are very similar and higher (73.4-85.5%) than control (WP) (38%). In the case of experiments C and P the elimination of VFAs was optimal and in the range of 63-83% typical from sewage anaerobic digestion process. In the case of G pretreatment, the removal of VFA was reduced (about 3.5%) due to the substrate was worse conditioned by using glucanase.



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

Maximum values of biomethane production (72 mL CH4)were obtained using substrates pretreated by P treatments. On the other hand, C experiment only produce 33.2 mL CH4 biogas, probably due to lower values of VFAs removal. Glucanase also increase biomethane production generating values between 30 mLCH4 in 20 days. Regarding that, control sample (WP) produced only 20 mLCH4.

**4. Conclusions**

Any of the tested pretreatments enhance biomethane generation. Pretreatment of protease is the best pretreatment enhancing biodegradability of substrates as well as biomethane production.

**References**

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2. G. Zhen, X. Lu, H. Kato, Y. Zhao, Y.Y. Li, Renew Sust Energ Rev 69 (2017) 559-577.