Stages and operational conditions tested in the OSA system

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# Pretreatment application of mixed sewage sludge on self-fermentation for biohydrogen production

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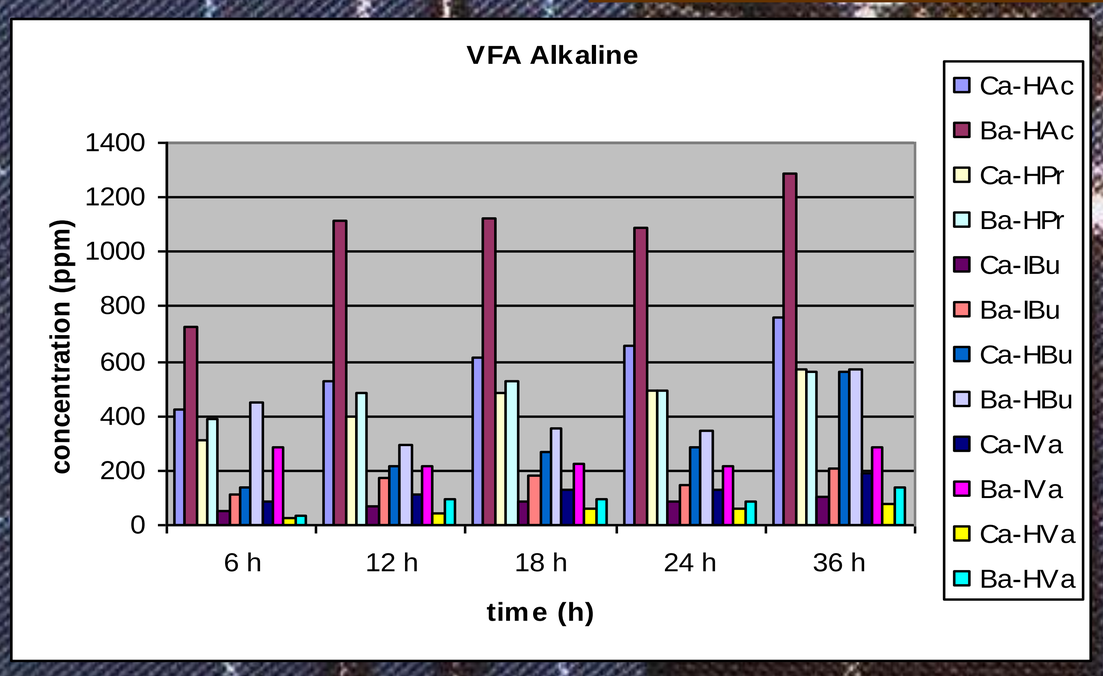
## ABSTRACT

**The influence of different types of pretreatments had been evaluated to establish their effect on the suitability for hydrogen production from mixed sewage sludge (combination of primary and activated sludge.**
**Four different pretreatments (thermal shock, freezing-thawing, base and 1-iodopropane) were chosen to compare their impact and effectiveness in the anaerobic self-fermentation production of hydrogen. The major release of biohydrogen was observed in the treatment carried out with NaOH, which also achieved the best removal of methanogenics. This is also the most effective in ratio of conversion to VFA from VS. Best results of potential hydrogen production, *P*, indicate that freezing-thawing treatment gains a 725% compared with raw mixed sludge.**
**Other parameters as variations in pH, soluble chemical oxygen demand (SCOD), the volatile and total solids and composition of biogas generated were measured during 36 hours of test duration.**

## METHODOLOGY

**The tests were carried out in serum bottles of 0.5 L. Temperature was controlled thermostatically in a water bath at mesophilic conditions (35ºC). The tests were conducted under discontinuous conditions (batch), no additional supplies were added during the study period. In both batches were included a control sample ("Ca" and "Cb" samples).**
**The alkaline treatment (named "Ba") was completed establishing a pH near 10. 1-iodopropane ("Io") were added at a rate of 0.2 g/L,. Thermic shock (called "Th") was performed by boiling the sludge for 15 minutes. Freezing and thawing ("Fr") was carried out using liquid nitrogen to freeze and thawing was carried out at room temperature**
**The parameters were: soluble chemical oxygen demand (SCOD), total solids (TS), volatile solids (VS), volatile fatty acid composition (VFA), and the volume and composition of gas generated.**

## RESULTS AND DISCUSION




- **As a result there was a small amount of hydrogen in control samples (untreated). The highest yields were observed for the samples treated by freezing and thawing (0.0975 mL H2/g VS), much higher than values recorded in the corresponding control sample (0.0133 mL H2/g VS), representing an increase of more than 725%.**
- **The samples that have proven most effective in the elimination of methane production have been treated with alkali, in which no methane was detected in any collected samples. Treatments carried out by heat shock and freezing-thawing have also proved effective, although the latter is observed that the rate of methane produced low to 0% at the end of this study.**

## CONCLUSIONS

**The reasons of the hydrogen consumption in this study are several, among them is the presence of homoacetogenic bacteria capable of hydrogen consuming, spore forming and resist many treatments.**
**Another reason is that the increase of VFA, specially acetic acid, who can inhibit the growth of hydrogen producing bacteria and therefore the ratio of production. The last reason is that in protein degradation occurs not only $H_2$ production but also consuming this molecule.**
**Studies have shown the possibility of using mixed sewage sludge as substrate for the production of H2 and opens the door to further experiments.**
**Pretreatments to individually and their combination are presented as the basis for the development of techniques for extracting a resource from a waste, giving it added value.**

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