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EFFECT OF ULTRASOUND IN CRUDE GLICEROL AS PRETREATMENT FOR METHANE PRODUCTION

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ABSTRACT
As global energy supply is based on petroleum derivate, scarcity of natural sources and environmental concerns are problems associated to the energy supply as well as the increasing demand. Renewable energy sources can replace this conventional energy source and decrease the environmental emissions.. In this work is going to be evaluated the effect of ultrasound pretreatment on crude glycerol from biodiesel production process to improve the methane production from biogas in an anaerobic digestion process. Different times of pretreatment are going to be examined 10, 15 and 30 minutes to determinate the best performance and compare it to the untreated substrate. The results showed that ultrasound pretreatment improved methane production by using 30 minutes of treatment on crude glycerol.

Keywords: Glycerol. Anaerobic digestion. Ultrasound pretreatment.

INTRODUCTION
Environment concerns as air pollution, acid precipitation, ozone depletion, deforestation and the gaseous emissions to the atmosphere are associated to the use of petroleum derivate [1]. Renewable energy sources have the potential to provide the energy demand with almost zero emissions to the atmosphere [2]. Biofuels are a renewable energy source produces from natural matter. They can be considered a substitute for petroleum fuels. They can be solids as bio-char, liquid as ethanol or biodiesel or gaseous as biogas [3].
Crude glycerol is a residue of biodiesel production and besides its application in chemical industry, can be used to produce energy from anaerobic digestion process, to obtain biogas [5, 6]. One of the objectives in biogas production process are the quality of methane and the reduction of retention time in the reactor. Therefore, many different pretreatments were studied. Ultrasound treatment is a mechanical treatment that degrades by pressure. Is a cycle sound pressure frequency that produces bubbles in substrate. After this treatment, organic matter is solubilized and able to be reach by microorganisms to carry out the hydrolysis [13].
The aim of this work is to investigate the effect of ultrasound as a pretreatment in crude glycerol from biodiesel's production process to produce biogas in anaerobic digestion and with this to present an alternative of renewable energy production.

MATERIALS AND METHODS

Anaerobic digestion system
To evaluate the methane production, the anaerobic digestion was carried out in batch reactors (500 ml) system for 32 days under mesophilic conditions (37°C). Different times of ultrasound pretreatment were tested (10, 15 and 30 minutes) of glycerol treatment and compared with glycerol

untreated. The methane production was daily measured by the volumetric analysis, washing the biogas in sodium hydroxide (3%).

Inoculum and substrate

The inoculum used in the tests was anaerobic sludge from a septic tank of Bragança, Portugal. As substrate was used crude glycerol from biodiesel's production process, obtained from the Laboratory of Biofuels, ESTIG, IPB (Bragança's Polytechnic Institute) Bragança, Portugal.

Physicochemical characterization of inoculum and subtract were performed according to [8] procedures for total solids (SF), fixed solid (FS) volatile solids (VS) and the chemical oxygen demand (COD). In each reactor, was used the proportion of 99% of inoculum and 1% of substrate.

RESULTS AND DISCUSSION

The results obtained in the COD tests performed to the content of each reactor to be submitted to anaerobic digestion shows and increment of 127,150 and 155% for 10, 15 and 30 minutes of ultrasound pretreatment. According to [15] ultrasound pretreatment increases the value of COD because ultrasonic time affect significantly the disintegration of organic matter. They performed ultrasound pretreatment to study the effect on COD in activated sludge for digestion. After performing the anaerobic digestion process, the results exhibit that VS decreases from 19.4 g/l to 14.1 g/l for 10 minutes, 11.8 g/l to 15 and 8.5 g/l to 30 minutes of pretreatment and TS from 30 g/l to 2.8 g/l for 10 minutes, 26 g/l to 15 and 19 g/l to 30 minutes of pretreatment The measurement of methane volume produced in the tests for the different times of ultrasound pretreatment is resumed in the figure 4. According to these results, for a time of 30 minutes of ultrasound pretreatment were produced the major quantity of methane, 663.83 ml, if compared with the other trials. Crude glycerol that were treated for 10 and 15 minutes registered 27.8 mland 48.1 ml compared to 250.4 ml produced by the crude glycerol without treatment.

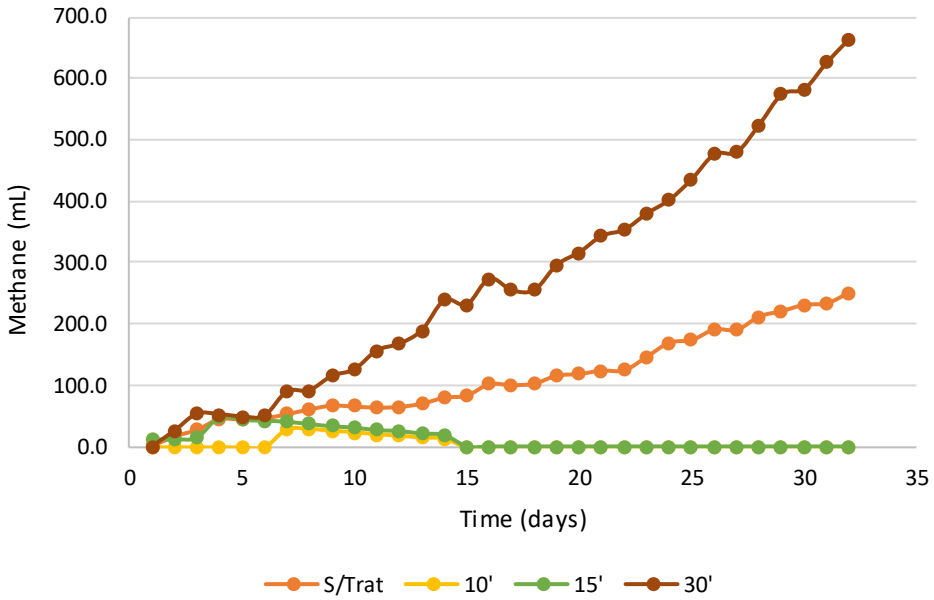

Figure 4. Volume of methane produced for each time of ultrasound treatment and without treatment.

Ultrasound pretreatment in crude glycerol, cattle manure and food waste were evaluated by [5].Tests were performed with a 3% of glycerol in co-digestion in an unspecified pretreatment time. Results agree that the ultrasound pretreatment increased methane production, increasing COD and disintegration of organic matter.

CONCLUSION

The results showed that ultrasound pretreatment of 30 minutes improves the anaerobic digestion and produced 663.83 ml ml de methane.

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