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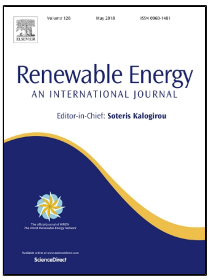

Biotechnological products in batch reactors obtained from cellulose, glucose and xylose using thermophilic anaerobic consortium

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Biotechnological products in batch reactors obtained from cellulose, glucose and xylose using thermophilic anaerobic consortium

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ABSTRACT

Lignocellulosic residues used for biofuel production is an alternative source to increase the energy supply. However, the cellulose found in this biomass must be made available in fermentable sugars, requiring a complex enzymatic mechanism only found in specific microorganisms. Some thermophilic and anaerobic bacteria of the *Clostridium* species are able to produce cellulolytic enzymes and metabolize pentose and hexose to ethanol. Therefore, we evaluated the degradation of cellulose, glucose, and xylose through the use of a thermophilic microbial consortium and ethanol production. The batch tests were performed in *Thermoanaerobacter ethanolicus* medium at 55°C, pH 7. The tests were performed using 5.51 mmol/L glucose, 8.06 mmol/L xylose and 1g/ L cellulose. The highest ethanol yield was observed in the reactor with glucose (1.73mol-EtOH/mol-glucose), followed by the reactor with xylose (1.33mol-EtOH/mol-xylose). In contrast, the reactor with cellulose exhibited lower ethanol yield ($1.88.10^{-3}$mol-EtOH/g-cellulose), acetic acid and methane were also observed. Bacteria similar to *Caloramator* sp., *Fervidobacterium* sp., *Thermoanaerobacterium* sp. and *Ethanoligenens* sp. were identified by Illumina MiSeq sequencing, all related to the ethanol production.

Keywords: *Thermoanaerobacterium*, *Caloramator*, methane, acetic acid.

1 INTRODUCTION

The current energy scenario is defined by the scarcity of fossil fuels, the lasting environmental impacts caused by the use of these fuels and by the increased energy demand. The production of renewables is a promising alternative to meet this scenario, considering that this goal can be achieved using vegetal biomass as a resource [1].

The biorefinery concept refers to the production of food, materials, chemicals, energy, fuel and heat through biomass-based biological processes [2]. Therefore, energy production (ethanol, methane, and hydrogen) and chemicals (acetic, butyric, and propionic acids) from anaerobic digestion of lignocellulosic biomass is extremely attractive for decentralizing the use of fossil resources and for producing renewable energy, since this biomass has high calorific value and is available as industrial and agricultural waste [3]. For example, the calorific value of different lignocellulosic biomasses are 17.6 MJ / kg for corn stover, 19.2 MJ / kg for olive husk, 19.6 MJ / kg for softwood, and 18.7 MJ / kg for wheat straw, among others [4], [5].

Ethanol is the most prominent biofuel because of its direct energy competitiveness with fuel made from petroleum, gasoline, which already has a defined production technology. It is a primary alcohol produced from the fermentation of pentose/hexose sugars found in various plants, such as corn, beet, cassava, wheat and sugarcane [6].