

Evaluation of different natural microbial consortia for H₂ production from crystalline cellulose

A.L. Morales-García¹, A. Escalante², GML Ruiz³, J González Castañeda³, I. Valdez-Vazquez^{3*}

¹Universidad del Mar, Campus Puerto Ángel, C.P 70902, Oaxaca

²Instituto de Ecología, UNAM,

³Departamento de Ciencias Ambientales, División de Ciencias de la Vida

Universidad de Guanajuato, Campus Irapuato - Salamanca

Ex Hacienda El Copal Km. 9, Carretera Irapuato-Silao, C.P. 36500, A.P 311

Irapuato, Guanajuato, México.

* mail: valdez_idania@yahoo.com

ABSTRACT

Cellulose is the biopolymer most abundant in the nature being the main component in the plant biomass, besides, cellulose could be an excellent substrate for hydrogen production using fermentative bacteria. In the most of the studies about biofuels from cellulose, it is necessary the cellulose saccharification and then the fermentation of the released sugars. However, microbial consortia present in the nature are able to hydrolyze and ferment cellulose in one step. The objective of the work was to evaluate the performance of 3 microbial natural consortia for hydrogen production using crystalline cellulose as the only source of carbon. The natural consortia used were taken from sludge from a wastewater treatment plant, garden soil and cow rumen. Inocula were heat-treated for 30 min at 90°C in order to eliminate the H₂-consumers (methanogens). Three reactors were loaded with 250g of each inoculum and 250 mL of a mineral medium (composition per liter (g/L): KH₂PO₄, 44.8; K₂HPO₄, 6.98; MgC₁₂ 6H₂O, 0.1; CaCl₂, 0.02; yeast extract, 5; L-cysteine, 0.5 mmol; MnSO₄ 6H₂O, 0.015; FeSO₄ 7H₂O, 0.025; CuSO₄ 5H₂O, 0.005; CoCl₂ 5H₂O, 0.000125) and cellulose as source of carbon (5 g/L). The headspace was changed with nitrogen for 5 min to ensure the anaerobic conditions. Then, the reactors were hermetically closed and operated at ambient temperature (± 32 – 35°C) with constant agitation (120 rpm). The parameters determined were cellular growth by protein, accumulated biogas by brine displacement, percentage of hydrogen by GC TCD, substrate consumption by total carbohydrates and pH. The results showed that the type of inocula had a significant effect on the hydrogen production. The higher productivity was reached using garden soil as source of inoculum, followed by cow rumen and finally the sludge from the wastewater treatment plant. Also, the highest cellular growth was reached in the reactor inoculated with the garden soil, which is related with the highest productivities of hydrogen.

