

# Hydrogen generation by photoheterotrophic bacterial consortia with organic wastes

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## Abstract:

The bioconversion of different organic materials to hydrogen is a sustainable technology. Inocula from tropical climates such as Brazil which average temperatures around 25°C may favour the bacterial growth. Hydrogen generation with bacterial consortia have advantages over pure cultures regarding application to wastewater treatment. The hydrogen can be generated in two stages during the anaerobic processes. Firstly, hydrogen and organic acids can be produced by dark fermentation. The acids generated during the first stage of the fermentation process can be used by phototrophic bacteria in the second stage during the operation of anaerobic batch reactors on the light presence. The aim of this study was evaluate the hydrogen producing potential from organic wastes by phototrophic bacterial consortia. The inoculum sources were from the Activated Sludge System treating domestic sewage (Araraquara-SP-Brazil), reactivated for 72 hours on synthetic media ATCC112 (Van Niel, 1944), pH 7, at 37°C, 5000 lux in anaerobic conditions. Assays (I, II and III) were made separately in triplicates of anaerobic batch reactors with different concentrations of butyric acid and crude glycerol from a pilot plant of biodiesel production by transesterification process with the used cooking oil (BIOTEXX - UNIARA - Araraquara - SP) *Rhodospirillaceae* medium (Chi Mei Lee, 2005) headspace with N<sub>2</sub> (100%), pH 7.0±1, at 37°C, 5000 lux. The assays were prepared as follow: (I) 0.5 g L<sup>-1</sup>, (II) 1 g L<sup>-1</sup> of butyric acid and (III) 0.5 g COD L<sup>-1</sup> of crude glycerol. High cellular growth (ABS<sub>660</sub>) was observed [1.6, 1.6 and 1.7] at 54, 54 and 46 hours, respectively for the assays (I), (II) and (III). The maximum H<sub>2</sub> generations were done by gas chromatography (4.0, 4.4 and 15.0 mmol H<sub>2</sub> L<sup>-1</sup>), observed at 84, 84 and 96 hours, respectively during the essays (I), (II) and (III). Microscopic analysis of biomass showed the predominance of Gram negative rods; which morphology is characteristic of phototrophic H<sub>2</sub>-generating bacteria. The pH observed for essays (I) 9.1 (II) 9.2 and (III) 10.1 respectively could justify the consumptions of organic acids by the phototrophic consortia at the end of operation. The phototrophic bacterial consortia showed high potential on hydrogen bio-production and they can be applied on organic wastes containing volatile acids.

**Keywords:** butyric acid, crude glycerol, photoheterotrophic bacterial consortia, hydrogen bio-production.

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