Enhanced bioH_2 and Poly-hydroxyalkanoates production by a co-culture of *Syntrophomonas wolfei* and a photoheterotrophic mixed consortium using a dark- fermentation effluent as substrate

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Nowadays, the pollution by oil-based derivatives such as gasoline, polyethylene, etc is getting problematic. One possible way to overcome this issue is by developing alternative green technologies. The bio-plastics production seems to be a promising method to reduce the plastics production. Polyhydroxyalkanoates as the copolymers of PHB and PHV have similar characteristics of the polyethylenes, therefore many applications. *Synthrophomonas wolfei* (*S. wolfei*) and some photoheterotrophic bacteria are able to produce this polymer from the effluents of organic residues treatment. Moreover, these microorganisms may produce bioH_2 depending on the culture conditions. However, the production of biopolymers based on the bacteria metabolism is nowadays still more expensive than synthetic production. This condition motivates the research to optimize the biological process to make it competitive compared to the regular oil-based method. The purpose of this study was to develop the syntrophic consortium composed by *S. wolfei* and a photoheterotrophic mixed consortium named C-4. This strategy would allow to improve the simultaneous production of bioH_2 and PHA. The dark-fermentation effluent was used as substrate during the photoheterotrophic process. This effluent consists of a complex mixture of volatile fatty acids including acetic, butyric, lactic, propionic and some others. The data demonstrated the syntrophic activity between *S. wolfei* and C-4 based on the comparison of PHA and H_2 productions from the individual and co-culture fermentations. The individual cultures showed that consortium C-4 and *S. wolfei* can use the effluent as a carbon-nitrogen source. *S. wolfei* produced higher concentration of bioH_2 but lower PHA production compared with C-4. The co-culture produced this bioproducts simultaneously, with 25% PHA and 90 mmol v/v H_2 at 100 and 75 hours respectively. The profile of volatile fatty acids consumption explained the interaction between C-4 and *S. wolfei* suggesting a mutualism.

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