Conversion of 1,3 propanediol into 3-hydroxypropionic acid by *Acetobacter aceti*

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3-hydroxy propionic acid (3-HP) is a key synthon enabling the bio-sourcing of acrylic acid and other important chemicals. One of the possible precusors of this molecule is 1,3 propanediol (1,3 PDO). This molecule is produced by various micro-organisms. *Lactobacillus reuteri* is a bacteria that is able to produce an equimolar mixture of 1,3 PDO and 3-HP from glycerol in a fed batch system. In the present work we checked whether acetic acid bacteria could convert residual 1,3 PDO into 3-HP and under which conditions.

We first grew *Acetobacter aceti* in ethanol (8g/l) and we then tested its ability to convert 1,3 PDO into 3-HP in well aerated baffled Erlenmeyer flasks or in an aerated fermenter. *Acetobacter aceti* was grown on a medium with 8g/l of ethanol as substrate, with tryptone 3g/l, Yeast extract 5g/l and K_2HPO_4 50mM (pH=7,0). At the end of the exponential phase (about 24h), the cells were concentrated by centrifugation and re-suspended in the same sterile medium (the final cell concentration factor was 2, $O.D._{620}$=3). with a similar composition as the one used for the growth phase. 1,3PDO was used as the sole carbon source and it was tested at three levels (10, 20 and 40g/l). Tests were carried out at least in triplicate. It was shown that in 24h up to 12g/l of 1,3 PDO was completely converted into 3-HP. Maximum conversion rate was achieved when 20g/l of 1,3 PDO was used and reached up to 0.4g.l^{-1}.h^{-1}.

The objective was to obtain a complete conversion of glycerol into 3-HP. Therefore a conversion of 1,3 PDO and 3-HP by *A.aceti* was evaluated before testing the more complex system issued from a culture of *Lactobacillus reuteri.* It was shown that when up to 20g/l of the 2 compounds were added into the medium, 1,3 PDO was consumed and 3-HP was produced with a productivity of 0,3g.l^{-1}.h^{-1}. This productivity reduced quickly as conversion progressed.

Finally the conversion by *Acetobacter aceti* of an effluent of culture of *Lactobacillus reuteri* was tested. The culture medium was obtained from a fed batch culture of *Lb reuteri* containing 12g/l of 3-HP and 10g/l of 1,3PDO.

The effluent was separated into three to cultivate *A. aceti*.

1.*Acetobacter* was cultivated in the whole culture of *Lb reuteri*,

2.The cells of *Lb reuteri* were removed from the culture medium, this medium was mixed with the medium described in the previous paragraph (1vol/vol) before cultivation by *A. aceti*,

3. *A. aceti* was cultivated without the cells of *Lb reuteri* and without extra medium.

In all 3 cases the bioconversion of 1,3PDO happened and between 16 and 19g/l of 3-HP was found after 24 hours. In all cases there was 1,3PDO remaining, between 4 and 7 g/l, indicating an incomplete bioconversion.

The HPLC measurements have shown that when 1,3PDO is in excess, some 3 hydroxypropionaldehyde,which is very toxic to the cells, is also present in the medium. An adapted control of the 1,3 PDO addition to the acetobacter culture may probably prevent this problem.