



HAL
open science

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

Claire Saulou-Berion, Alexandre Santinho, Violaine Athès-Dutour, Marwen Moussa, Florent Allais, Henry-Eric Spinnler

► **To cite this version:**

Claire Saulou-Berion, Alexandre Santinho, Violaine Athès-Dutour, Marwen Moussa, Florent Allais, et al.. Conversion of 1,3 propanediol into 3-hydroxypropionic acid by *Acetobacter aceti*. 17th International Biotechnology Symposium and Exhibition, Oct 2016, Melbourne, Australia. hal-01564503

HAL Id: hal-01564503

<https://agroparistech.hal.science/hal-01564503>

Submitted on 19 Oct 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - ShareAlike 4.0 International License

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

Saulou-Bérion^{1,2} Claire, Alexandre Santinho^{1,2}, Violaine Athes^{1,2}, Marwen Moussa^{1,2},
Florent Allais^{1,2,3}, Spinnler Henry Eric^{1,2}

1: AgroParisTech, UMR782 Génie et Microbiologie des Procédés Alimentaires, 78850 Thiverval-Grignon, France ;

2 : INRA, UMR782 Génie et Microbiologie des Procédés Alimentaires, 78850 Thiverval-Grignon, France;

3 : AgroParisTech, Chaire ABI (Agro Biotechnologies Industrielles), Centre Européen de Biotechnologie et de Bioéconomie

3, rue des Rouges Terres, Route de Bazancourt, 51110 Pomacle, France ;

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 precursors 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 acetii* 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 acetii* was grown on a medium with 8g/l of ethanol as substrate, with tryptone 3g/l, Yeast extract 5g/l and K₂HPO₄ 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.acetii* 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 acetii* 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. acetii*.

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. acetii*,

3. *A. acetii* 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.