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Lactic acid production via High Gravity Enzymatic Hydrolysis and Fermentation by Lactic Acid Bacteria

Asimakopoulou G.[1], Karnaouri A. [1], Perraki D.[1], Kalogiannis K.[2], Lappas A.[2], Topakas E.[1]

[1] *Biotechnology Laboratory, School of Chemical Engineering, National Technical University of Athens, Athens, Greece*
[2] *Chemical Process and Energy Resources Institute (CPERI), CERTH, Thessaloniki, Greece*

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Lactic acid (LA) is a valuable compound with various applications in food, pharmaceutical and chemistry industries. Moreover, it attracts great interest for its biodegradable polymerized form—polylactic acid (PLA), a biodegradable and biocompatible polymer with a multitude of applications. LA can be produced by either chemical synthesis or microbial fermentation. A biological method has the advantage that an optically pure LA can be obtained by employing specific strains of lactic acid bacteria (LAB), whereas chemical synthesis always results in a racemic mixture of LA. Low-cost, renewable, non-edible materials, especially lignocellulosic biomass from agricultural, agro-industrial and forestry sources, are of great interest for lactic acid production. Using lignocellulosic biomass to produce chemicals is a promising way to alleviate significant bottlenecks in the supply of energy resources; however, efficient bioconversion of biomass to LA still faces considerable challenges, including the difficulty of using lignocellulosic biomass due to its complex structure and recalcitrance. In the present work, lignocellulosic biomass was used as a substrate for the production of highly-concentrated sugar streams able to support the growth of LAB strains and the efficient yield of LA. Mild oxidative organosolv pretreatment of biomass using aqueous solutions of organic solvents took place as an initial step in order to remove lignin fraction, disrupt the rigid structure of the material and render it more amenable to enzymatic hydrolysis. Simultaneous saccharification and fermentation (SSF) using Cellic® CTec2 (Novozymes) enzyme and *Lactobacillus delbrueckii ssp. bulgaricus* was used for the production of fermentable sugars and their subsequent bioconversion to LA respectively. To make the production of LA economically viable and at the same time reduce the environmental impact of the process, high initial solid concentration of the substrate (15% initial dry matter) during saccharification and fermentation was investigated.

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