New Strategies for Green Butanol Production

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Motivation

New national and international policies are pushing for a more sustainable production landscape. Once seen as waste, many resources are now the focus of valorization and recovery. Mixed culture biotechnology is held as a promising solution for producing valuable biofuels and chemicals from such low-value substrates and waste streams. In this context, butanol is a biofuel of particular interest.

Why biobutanol?

Motivation

Why microbial mixed cultures?

<table>
<thead>
<tr>
<th>Microbial mixed culture</th>
<th>Sterile pure culture</th>
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<tbody>
<tr>
<td>Cheap waste streams</td>
<td>Expensive high-grade substrates (sterile)</td>
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<tr>
<td>Continuous</td>
<td>(Fed) batch</td>
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<tr>
<td>Ecological selection</td>
<td>Genetic engineering</td>
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<tr>
<td>Resource and energy</td>
<td>Single product,</td>
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<td>recovery</td>
<td>maximized yield</td>
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</table>

Enrichment strategy

Starting from non-defined methanogenic communities fed on butyrate and H₂, butanol-producing microorganisms are enriched through directed ecological selection in a continuously-stirred tank reactor. Operating at high H₂ partial pressure of 1.0 to 1.5 bar, (1) anaerobic butyrate conversion becomes thermodynamically unfavorable, and thus also (2) acetoclastic and (3) hydrogenotrophic methanogenesis, reducing the amount of CH₄ and CO₂ produced as by-products.

Why microbial mixed cultures?

Properties similar to gasoline

Drop-in replacement for fossil transport fuels

References


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