Succinic acid production from Jerusalem artichoke

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Succinic acid production from Jerusalem artichoke tubers

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Succinic acid

• Succinic acid is currently produced from petro chemicals.
• Has applications in agricultural, food, chemical and pharmaceutical industries.
• A. succinogenes 130Z produces succinic acid in large amounts during fermentation.
• Theoretically consumes 1 mol CO\textsubscript{2} per 1 mol succinic acid produced.
• Could contribute to the abatement of CO\textsubscript{2} emissions at a time when CO\textsubscript{2} levels in earth’s atmosphere are at an all time high (>400 ppm).

Jerusalem artichoke tubers

• Root vegetables rich in inulin.
• Inulin is a D-fructose and D-glucose polysaccharide.
• Poor digestibility in humans.
• Investigate using Jerusalem artichoke tubers for producing succinic acid.

Results

Fermentation of pure sugars (batch bottles):
Succinic acid (SA) yield was 83% when D-glucose was the substrate compared to 72% yield SA when D-fructose was the substrate.

D-glucose utilization was 93% compared to 88.5% D-fructose utilization.

<table>
<thead>
<tr>
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<th>Glucose (g/L)</th>
<th>Fructose (g/L)</th>
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</thead>
<tbody>
<tr>
<td>Initial</td>
<td>48.0±0.5</td>
<td>46.2±0.3</td>
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<tr>
<td>48 hours</td>
<td>3.4±0.2</td>
<td>5.4±0.1</td>
</tr>
</tbody>
</table>

Succinic acid yield* (%): 83.0±1.3

Fermentation of tuber hydrolysates:
SA yield was 80.2% in bottles compared to 77.9% in 3-L bioreactor. However, the SA production was increased by 26.4% in 3-L bioreactor and the D-fructose utilization increased from 68.5% to 96.5%.

Conclusions

• This is the first report on the use of Jerusalem artichoke tuber hydrolysate as substrate for succinic acid production by A. succinogenes.
• Succinic acid was successfully produced, where the highest succinic acid concentration was 26.8 g/L and the highest succinic acid yield observed was 80.2%.
• A. succinogenes 130Z utilized both D-fructose and D-glucose in the tuber hydrolysates.
• The importance of pH control and its effect on D-fructose utilization during succinic acid production was clearly observed when results from batch bottles and 3-L bioreactor were compared.
• Jerusalem artichoke tubers as raw material for succinic acid production is a very attractive option compared to other types of biomass tested for succinic acid production.