Bio-methane potential of by-products from cassava starch processing

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Focus
Aim of the study was to examine the bio-methane potential of cassava root peels and cassava pulp.

Special focus:
- Essential micro nutrient content
- Influence of protective wax layer and residual starch content

Methods
- Micro nutrient content and C/N ratio of cassava root peels (1A) and cassava pulp (1B) was determined.

- Peels were classified:
  - P1= starch / no wax
  - P2= no starch / wax
  - P3= no starch / no wax

- Specific methane yield was measured with Hohenheim Biogas Yield Test (1C) following standard VDI 4630.

Results
Content of essential micro nutrients per kg total solids (TS) in cassava peel and cassava pulp are shown in the following table.

<table>
<thead>
<tr>
<th></th>
<th>C/N</th>
<th>Co</th>
<th>Cu</th>
<th>Mo</th>
<th>Ni</th>
<th>Se</th>
<th>Fe</th>
<th>Mn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peel</td>
<td>39:1</td>
<td>0.50</td>
<td>3.0</td>
<td>0.30</td>
<td>4.60</td>
<td>&lt;0.05</td>
<td>500</td>
<td>46.9</td>
</tr>
<tr>
<td>Pulp</td>
<td>124:1</td>
<td>&lt;0.05</td>
<td>73.1</td>
<td>&lt;0.05</td>
<td>1.02</td>
<td>&lt;0.05</td>
<td>11.50</td>
<td>3.33</td>
</tr>
<tr>
<td>Min.</td>
<td>10:1</td>
<td>0.4</td>
<td>10</td>
<td>1</td>
<td>3</td>
<td>0.2</td>
<td>1500</td>
<td>100</td>
</tr>
</tbody>
</table>

Content of micro nutrients is lower compared to the minimum level required for a stable nutrient supply of bio-methane bacteria population. C/N ratio of root peels is within the range recommended for biogas substrates. For pulp C/N ratio is broad, showing need for increased attentiveness if utilized as substrate.

Single substrate bio-methane yields for peels and pulp are displayed in Fig. 2.

![Fig. 1A](image1a.png) ![Fig. 1B](image1b.png) ![Fig. 1C](image1c.png)

Fig. 1A: Cassava root peel; Fig. 1B: Cassava pulp; Fig. 1C: Hohenheim Biogas Yield Test

![Fig. 2](image2.png)

Fig. 2: Specific methane yield (SMY) per kg volatile solids (VS) within test period (35 d).

<table>
<thead>
<tr>
<th>Sample</th>
<th>SMY, m³N·kg VS⁻¹</th>
</tr>
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<tbody>
<tr>
<td>Pulp</td>
<td>0.29</td>
</tr>
<tr>
<td>P1</td>
<td>0.31</td>
</tr>
<tr>
<td>P2</td>
<td>0.29</td>
</tr>
<tr>
<td>P3</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Conclusions
- Content of essential micro nutrients shows the necessity of co-digestion of cassava by-products
- Specific CH₄ yields of investigated cassava products are equal to cattle and pig manure
- Utilization of cassava by-products for bio-methane generation can increase use efficiency of cassava starch process chain

1Oechsner, H (2011). Biogas in der Landwirtschaft - Stand und Perspektiven, KTBL-Schrift 488