Market potential for products from green biorefining

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Challenges for green bio-refineries – from a market perspective

• Availability of feedstocks (some only in limited volumes);

• The supply chain from feedstock production to bio-refinery, and to the market;

• Market size and readiness
Status of biorefinery concepts

Technological maturity (TRL)

9  System in successful operation
8  Qualified and complete system (reference)
7  Demonstration in operation
6  Demonstration in in a relevant operational environment
5  Technical validation in a relevant operational environment
4  Validation in the laboratory
3  Proof-of-concept
2  Description of a technology concept
1  Description of the functional principle

Commercial phase (TRL 9)

Pilot-/demonstration-/reference phase (TRL 5–8)

Laboratory-/pilot plant stage (TRL 2–4)

Biorefinery concepts

- Sugar-BR
- Vegetable oil-BR
- Lignocellulose-BR (pulp)
- Lignocellulose-BR (fermentable CH)
- Green BR
- Synthesis gas-BR
- Biogas-BR

KH: Kohlenhydrate
### Processing of grass juice and potential applications and markets

<table>
<thead>
<tr>
<th>Product</th>
<th>Application</th>
<th>Market size</th>
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<tbody>
<tr>
<td>Protein recovery</td>
<td>Animal feed</td>
<td>XXX</td>
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<tr>
<td>Amino acids mixtures</td>
<td>High-grade nutritional supplements, body care.</td>
<td>X</td>
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<tr>
<td>Lactic acid</td>
<td>Bulk chemicals</td>
<td>XXX</td>
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<tr>
<td>Lactic acid, organic acids</td>
<td>Chemical, food, feed sectors</td>
<td>XX</td>
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<tr>
<td>Bio-methane</td>
<td>biofuel</td>
<td>XXX</td>
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GrasPap from Germany

• Pellets made from hay and used as alternative fiber source in the paper and cardboard industries
• Grass fibers: 30-50 % of the final product, eg.:
  – Cardboard
  – Paper
  – Wall paper

• Added value:
Environmental sustainable, approved for food packaging material, natural and renewable raw material, and organic.

www.graspapier.de
Grasrap fibers from grass
Increasing demand for feed for organic layer hens

- 2018: EU requirements for 100 % organic feed;
- Market demand for organic protein increasing;
- Organic soya is cultivated in EU, but insufficient to cover demand;
- Alternative protein feeds such as starfish, algae, hemp, insects or grass protein?
Estimated demand for organic protein for layer hens in EU

• EU feed industry use 34.1 million T soya/year;
• Hereof 22 % is for layer hens = 7.5 million T soya;

• Organic hens make up 1 % of the inventory, and only 1% of the feed consumed = 75.000 T protein,
• If organic hens = 2 % of inventory = 150,000 T protein

• Estimated market for organic protein for organic layer hens: 100,000 T

• How much of this could be made from grass protein?
Examples of grass protein products for human nutrition – USA and Canada
Outlook for the market for green biorefinery-products

• Market demand for organic food products will increase further;
• The need for alternative solutions for organic protein feed is becoming more demanding;
• The applications for products from green biorefineries are developing – the step into a commercial set-up proves challenging
• Setting up a supply chain is a core element in the route from biorefinery to market
Thank you for your attention

Questions, please

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