Press release

nova-Institut GmbH (www.nova-institute.eu)
Hürth, 15 January 2019

Fermentable sugar as a raw material for the chemical industry: first generation as sustainable as the second – significant reduction in greenhouse gases for both

New study conducts quantitative and qualitative sustainability assessment of bio-based raw materials for the chemical industry

An extensive sustainability study carried out by nova-Institute shows that first-generation fermentable sugar is just as advantageous for a sustainable raw materials strategy of the European chemical industry as second-generation sugar. The results indicate that the poor reputation of first-generation agricultural commodities is in no way scientifically justifiable. It would therefore be counterproductive to restrict the use of sugar plants.

Twelve main criteria were selected to assess the sustainability of first and second generation fermentable sugars. The selection of criteria was based on the latest standards and certification schemes for bio-based fuels and materials, including a wide range of environmental, social and economic aspects. Because of the persistent accusation that the use of first-generation raw materials endangers food security, special attention was given to this particular criterion.
The analysis of the twelve different sustainability criteria shows that all examined raw materials display clear strengths in terms of sustainability, but also certain weaknesses:

All raw materials lead to a considerable reduction of greenhouse gas emissions (GHG). Although second-generation sugars perform better in this regard, the advantage is clearly put into perspective if it is offset against abatement costs. Reducing GHG emissions with second generation sugars is a comparatively expensive way to mitigate climate change.
Considering the often criticised aspect that the use of first generation raw materials has negative effects on food security, the findings actually point in exactly the opposite direction. Competition for arable land is offset by the excellent land-use efficiency of first-generation agricultural crops (especially sugar beet) and the presence of protein-rich by-products (especially wheat and maize). In this context, the use of short-rotation coppice (SRC) for sugar production represents much greater competition for arable land, since the same sugar yield requires a larger cultivation area and provides no additional protein by-products.
The results clearly show that the systematic discrimination of first-generation sugars in public perception and debate is in no way scientifically justifiable.
On the way to a climate-friendly Europe, bio-based chemicals from all raw materials offer advantages in terms of reducing greenhouse gas emissions and should equally be part of a sustainable future strategy for the European chemical industry.
The report analyses the strengths and weaknesses of all available raw materials for the production of bio-based chemicals, based on criteria such as greenhouse gas balance, greenhouse gas abatement costs, land efficiency, food security, protein by-products, employment, rural development, livelihood of farmers and forest workers, direct and indirect

risks of land-use change (LUC / iLUC), logistics, infrastructure, availability, traceability, social impacts, biodiversity as well as air and soil quality. The results for the individual plant groups can be summarised as follows:

Sugar plants

The greatest strength of sugar cane and sugar beet is their extraordinarily high land-use efficiency. No other biomass can produce so much fermentable sugar per hectare. A high reduction of greenhouse gas emissions and, above all, the lowest greenhouse gas abatement costs are further advantages. Infrastructure and logistics are well developed in this area and sugar beet by-products are used as animal feed. The biggest disadvantages are the effects of intensive agriculture on water, air and soil and the diversity of species – albeit limited to a comparatively small area due to the high land-use efficiency.

Starch plants

The main advantage of starch plants lies in their protein-containing by-products, which have a high value as animal feed. The land efficiency is lower than for sugar plants, but higher than for wood. The reduction of greenhouse gas emissions is lower than for other types of biomass. However, the comparatively lower GHG emission reductions are largely based on the specific life cycle analysis standards set out in the Renewable Energy Directive. Infrastructure and logistics are well developed for starch plants. The main disadvantages, as in the case of sugar plants, are the impact on water, air and soil and on biodiversity resulting from intensive agriculture.

Forest timber and short-rotation plantations

The greatest advantage of using wood as a raw material for the production of fermentable sugar is their low competition with arable land and thus the absence of LUC or iLUC. However, for short-rotation coppice this is only the case if they are not cultivated on arable land. In the case of wood, infrastructure and logistics are well developed; for SRC, this is less the case. The reduction in greenhouse gas emissions is in the same range as for sugar plants, but the greenhouse gas abatement costs are much higher. The main disadvantages in this area are the extremely low productivity per unit area and the lack of by-products for the feed market.

Waste and residual materials

The main strength of the use of waste and residual materials for the production of fermentable sugar lies in the highest reduction of greenhouse gas emissions of all compared groups – partly again due to the special life cycle assessment standards applied in the Renewable Energy Directive – and in the lowest impact on biodiversity, water, air and soil. The main disadvantages are high greenhouse gas abatement costs, poorly developed infrastructure and logistics, low traceability and, above all, limited availability.

The study is available free of charge at www.bio-based.eu/ecology

Responsible for the content under German press law (V.i.S.d.P.):

Dipl.-Phys. Michael Carus (Managing Director)
nova-Institut GmbH, Chemiepark Knapsack, Industriestraße 300, DE-50354 Hürth (Germany)

Internet: www.nova-institute.eu – all services and studies at www.bio-based.eu
Email: contact@nova-institut.de
Phone: +49 (0) 22 33-48 14 40

nova-Institute is a private and independent research institute, founded in 1994; nova offers research and consultancy with a focus on bio-based and CO_2-based economy in the fields of food and feedstock, techno-economic evaluation, markets, sustainability, dissemination, B2B communication and policy. Every year, nova organises several large conferences on these topics; nova-Institute has 30 employees and an annual turnover of more than 2.5 million €.

Get the latest news from nova-Institute, subscribe at www.bio-based.eu/email