Biomass unraveled: small-scale biorefinery for and by companies

On April 13th the results of the PPP (public private partnership) Small-scale Biorefining were presented during the ACRRES symposium Biomass unraveled. The results of the PPP constitute a good foundation for business cases and further research, which were discussed with over 60 interested participants in lectures, pitches and an exhibition floor.

ACRRES (Wageningen University & Research), supported by the Top Sector Agrifood and around 35 companies, has conducted research on small-scale biorefining in the past four years. In this PPP biobased solutions for promising business cases were identified and developed.

According to project leader Chris de Visser "Current knowledge on biorefining has made a big leap forward not only through successful projects such as 'Production of aquatic biomass on aquatic waste streams', 'Sludge as a resource for bioplastics' and 'Sugar beets as a resource for chemicals' but also through less successful projects such as 'Protein extraction from sugar beet leaves'. "

Small-scale biorefinery

An important result is that for example for protein biorefinery a smaller process scale is the best option. Usually a larger scale is preferable, especially in production companies with high overhead costs and resulting downward pricing effects. According to Marieke Bruins, senior scientist mild separation technologies at Wageningen Food & Biobased Research, this is not applicable to food industries. In this sector, a smaller process scale has many advantages like decreased transportation costs, increased storage times, lower waste production at the production site, higher income for the farmers, faster innovation possibilities and increased product quality through faster delivery. To succeed in this process, cost efficient procedures are a must. This involves the use of local waste streams for generating heat and energy to be used on site, and an efficient energy use. Dewatering is for example cost efficient on a small scale, but drying is not. Production for local or own markets is important. Reductions in man hours, automation, central support systems and the use of modular units, when the process can be used at multiple locations, are important as well.

Successful biorefining

As it turns out, in practice it is difficult to make biorefinery succeed. Bruins points out that this is due to the complexity of the processes. By definition, companies have to produce more products, which do not belong to the core business of the company. Etteke Wypkema, innovation manager at Water Board Brabantse Delta confirms this. Within the PPP, they worked on the project 'PHAs from residues', producing bioplastic from sewage sludge. Originally the water board has no knowledge on bioplastics, which makes definition of a quality product difficult. Therefore cooperations were set up with companies/knowledge institutes that have access to this knowledge, in this case Wageningen Food and Biobased Research.

'To make biorefining successful, bridges should be built and a network should be created with different companies and institutions', according to Rob Kwinten, Newfoss. They cooperated in the PPP to develop energy-conscious and natural extraction of steviolglycosides from Stevia.

Jerom van Roosmalen, Osomo, emphasized that in addition to a solid network also efficiency plays a major role. Osomo works on the production of LNG based on biogas. It is important not only to have a good quality product, but also an efficient process with minor losses, to be able to compete with the (still lower) price of natural gas.

Biobased products

Jan Broeze, Wageningen Food & Biobased Research, discussed raw materials screening with the purpose of mapping valorization options for byproducts and waste streams. What byproducts are suitable or less suitable for biorefinery?
A good example is the project, on which Rommie van der Weide, Wageningen University & Research ACRRES, worked. She investigated the valorization of waste streams with aquatic biomass. Aquatic waste streams are ideal for aquatic agriculture, for example algae production. Aquatic agriculture does not compete with arable land and can be used for chemical building blocks, in addition to food purposes.
Using waste streams is not only sustainable, but it can also offer a solution for depletion of declining fish stocks. Regular eating of fish is healthy because of omega 3 fatty acids, but fish are only rich in omega 3 because they feed on algae. Algae are therefore a sustainable replacement of fish regarding the production of these important fatty acids.
Also sugar beets are a good raw material for biobased products. Hans van Klink, director project development Dutch Sustainable Development BV, indicated that their company is well on its way to deliver on the promise that sugar beets are a good base for products in the chemical industry. Sugar is already often the building block for the production of molecules used in many consumer products. Sugar beets are the best raw material for this sugar.
Broeze showed that technical feasibility alone is not sufficient for the success of biorefinery processes. In parallel the economic feasibility should be tested. In this process it is important that during waste stream valorization less capital- and energy intensive processes take place and that a roadmap is constructed in which knowledge is addressed effectively/demand oriented and structured.
The day ended with a wrap up by Kees de Gooijer, chief inspiration officer for TKI Agri & Food. He indicated there's more work to be done. This does not concern short-term changes, but over the medium term many opportunities exist for bio energy. Chris de Visser concluded that the results of this PPP resulted in interesting business cases and that there's a proposal for a new PPP. During the drinks this proposal was further discussed with the companies present. To be continued!

Curious about all the results of the PPP Small-Scale Biorefining?
Here you can download the full report.