'Exploding' sugar beet cells for faster fermentation

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Sugar beet is an interesting raw material in the biobased economy as the sugars it contains can easily be fermented into valuable molecules. This does require a profitable process, however. The European ERA-NET innovation project ChemBeet is developing a very promising technology in which cells are exploded to create a faster and cheaper fermentation process.

"The sugar from sugar beet can be used to make other molecules which can then be used for a wide range of products," says Chris de Visser of Wageningen UR. "We are focusing on the first step: how can fermentation be used to convert the sugar into a usable molecule? Sugar beet is extremely interesting, especially since cultivation in the Netherlands has become highly efficient as a result of better varieties and breeding methods. This has significantly reduced the cost price, making the sugar beet a good option as a raw material for green chemistry."

Faster = cheaper

The problem is that the production process is currently fully focused on making granulated sugar. De Visser: "Converting sugars into substances such as ethanol, lactic acid or acetone obviously requires entirely different processes. The market won't be interested until the fermentation process needed to do this becomes cheaper and faster. Our challenge therefore is finding ways to make the micro-organisms realise a maximum yield as quickly as possible during fermentation."

Betaprocess

Within the remit of the ChemBeet ERA-NET innovation project, Wageningen UR is partnering with the company Dutch Sustainable Development BV (DSD) to realise further optimisation. At the testing facilities of ACCRES, Wageningen UR's practical application centre in Lelystad, scientists from both parties are gaining experience in the direct processing technology developed by DSD.

"This technology does not require lengthy pre-processing and allows us to process the entire sugar beet," explains Hans van Klink, director of DSD. "We use Betaprocess technology in which we apply so-called vacuum extrusion to explode the cell walls. As a result, the sugars are instantly exposed, allowing the micro-organisms to start their work more quickly. This saves time and – as the process takes place under low pressure and at low temperatures – energy."

More challenging than expected

The scientists in Lelystad are making progress says De Visser, although the co-innovation is more challenging than expected: "Our fermenter in Lelystad is on a very large scale, which means we encounter all sorts of bottlenecks that don't occur in the lab. For example, organic material has a certain degree of viscosity which creates problems in the fermenter. As a result the fermentation doesn't start as swiftly as we would like, and we are working hard on finding a solution. Thankfully, the issues we encounter are not insurmountable."

'Our plant'

Hans van Klink concurs. "Innovations such as these always proceed differently than expected. Luckily we have very suitable research facilities in Lelystad where we can find solutions together with the people of Wageningen UR. It is beginning to feel a little like it is our plant too."

Provided by Wageningen University