FIET Project 7: Drying of sticky products

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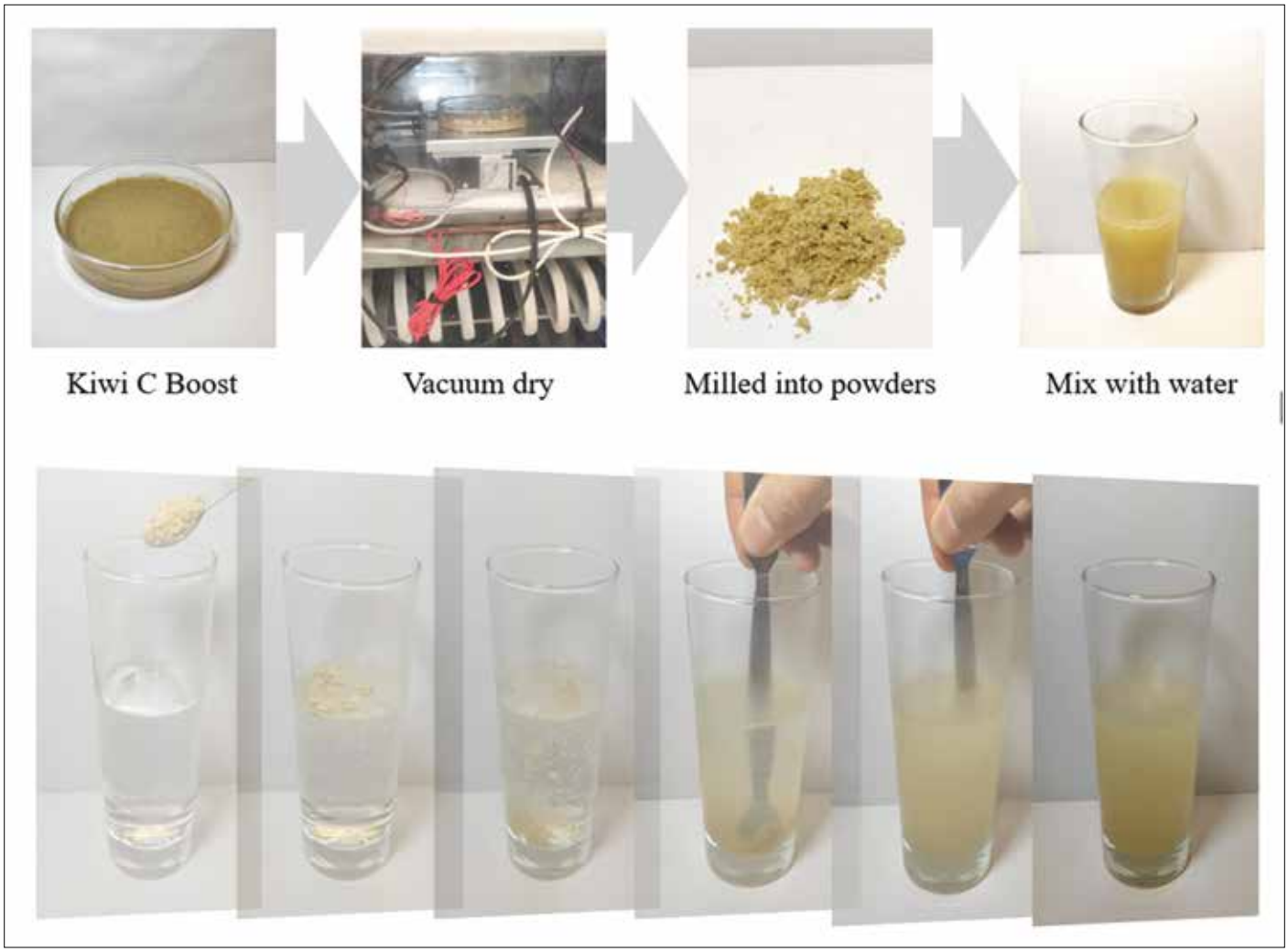
New Zealand networks work!

This project has an interesting back story typical of the classic Kiwi "two-degrees of separation". As mentioned, both Sebastian and Siti completed their PhD's in the first three years of the programme. In the second stage of the project, Sebastian was employed as a Post Doc, along with his then fiancé Dr Florencia Yedro. Florencia was initially a Post Doc on the related FIET project, pomace fracturing, which had come to an end. Six months into the project and with a lot of success in working out how to reduce the pomace fibre particle sizes, Florencia was snapped up by Fonterra's Research and Development Centre. By then Siti replaced Florencia in the Post Doc position. However, Fonterra Research again realised the quality of the people working on the project and offered Siti a job as well, which she accepted. Fortunately for our project, her husband, Aiman Jamsari, was just finishing his PhD and we were able to persuade him to come on board as a Post Doc, bringing his expertise in mechanical engineering into the mix. The timing of Aiman's arrival fitted perfectly with the stage of the project: modifying a spray dryer to be able to dry certain products that cannot be dried in a normal dryer.



There and back again: from juice to powder to juice - success!

Since we last reported on this project, the team of Dr Lee Huffman from Plant & Food Research, myself (Prof Tony Paterson), Sebastian Linnenkugel and Siti Mohd Rozali have made some exciting breakthroughs, and Sebastian and Siti have completed their PhDs.

Sebastian's PhD work on the prediction of the glass transition temperature of fruit juice powders from their composition formed the basis for being able to predict which juices can or cannot be successfully dried in a spray dryer in the absence of traditional drying aids. He developed a computer programme that predicts, given the conditions of the spray dryer, whether a powder will become sticky and require a drying aid (Linnenkugel, 2019). Siti's PhD focused on the effects of the rheological properties of complex model solutions and juices on their fluid flow and atomisation by spray dryer nozzles. She confirmed that two fluid nozzles are critical to the fluid flow for these complex model solutions.

Some fruit juices will never be able to be dried in a spray dryer without the addition of a drying aid (e.g. maltodextrin) in such large quantities (>50%) that you would essentially be drying maltodextrin with a fruit juice flavouring. Therefore, we decided to look at alternative drying technologies.

Atmospheric freeze-drying works but with these high-sugar juices it struggles to achieve low enough water activities to produce powders that will be stable during storage. At such low temperatures it takes days to dry the products.

Quotes from our partners

"We (JPNZ) are collaborating closely with the highly experienced and knowledgeable team at Massey and Plant & Food in the efforts to provide premium quality and sustainable food products to our customers. Their expertise and professionalism is helping us reach our goal of innovative food products faster."

Vidya Kethireddy
Technical & Quality Manager
Juice Products New Zealand
https://www.jp-nz.com/

"Kii Tahi is proud to be partnering with FIET in this innovative approach to drying our product. These trials will allow us to explore additional product ranges under our Kaitahi food and beverage business. Kaitahi is currently ranged in various stockists around Aotearoa https://kaitahi.co.nz/pages/stockists."

Dallas Hepi
Research and Development Manager
Kaitahi

"We continue to see new blackcurrant-based products coming into the market month on month in New Zealand, all championing the health benefits of the product. Blackcurrants are finally shaking off the old-fashioned image of sugary kids' drinks and grandma's jam. This doesn't mean that the unique taste profile of blackcurrants is any less important and bringing the two attributes together seems to be what the consumer is demanding of the brand owners and industry alike. We've always felt that a stable juice-based dry product without added sugar would deliver exactly this, and the opportunities for products derived from the FIET drying project are even greater now than when the project first evolved, so we are excited to be able to have this product on offer."

Mike Callagher – General Manager
New Zealand Blackcurrant Co-operative Ltd.
Website: https://www.nzblackcurrants.com/en/

We experimented with vacuum belt drying and vacuum freeze drying and found that, if the right conditions were used, it was possible to dry juices to low enough water activities that stable powders were achievable.

These optimal conditions are currently being assessed for IP protection and hence cannot be disclosed here. We are currently working with Juice Products New Zealand Ltd. and Kii Tahi and have successfully dried their products using our technique and the Bucher continuous vacuum belt dryer at the FOODBOWL, and are confident that we can dry almost all fruit juices after some further research work on specific products. We are currently looking for more juices to try and are in discussions with the NZ Blackcurrant Co-op to look at blackcurrant juice.

Reference

Linnenkugel, S. (2019). Prediction of the glass transition temperature of fruit juice powders. (PhD), Massey University

Food Industry Enabling Technologies (FIET) is funded by the Ministry for Business, Innovation and Employment and its purpose is to support new process developments that have the potential to add significant value to our national economy. The programme has six research partner organisations, Massey University (the host), Riddet Institute, University of Auckland, University of Otago, Plant and Food and AgResearch. Funding is $16.65m over six years (2015-2021) and targets pre-commercialisation activities. If you are interested in more information, then please contact either Dr Ross Holland (R.Holland1@massey.ac.nz) or Professor Richard Archer, Chief Technologist, (R.H.Archer@massey.ac.nz).