Institute for Sustainable Process Technology

Asparagus as a model for a 'Waste to Taste' initiative

Natural vegetable ingredients from vegetable waste

Project Acronym: Waste2Taste – WP1

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Project Title + Acronym	Asparagus as a model for a 'Waste to Taste' initiative: Natural Vegetable Ingredients from Vegetable Waste; Waste2Taste – W2T
Secretary (penvoerder)	ISPT
Name Cluster Director	Peter de Jong
Name project leader	Maarten Schutyser
PhD (name & title thesis)	Joanne Siccama (WUR Food Process Engineering): development of a new process to convert the waste stream of white Asparagus into a high value food ingredient with preserved flavour profile. Eirini Pegiou (WUR Plant Physiology, Metabolomics/Food quality): unravelling flavour formation by exploiting metabolomics approaches to explore the biochemical composition of white Asparagus.
Funding*	TKI Toeslag 2017 ** Final report on TKI2016 for 1st tranche of W2T project is available at TKI and merged with this final report.*
Project start	1-5-2018
Project original end date	31-08-2022
Project final end date	1-5-2023 Request for Change regarding prolongation of the project until maximum possible end date was granted by TKI Energy in December 2021.

Partners

Growers United (former DOOR Cooperation), Teboza Asparagus, Unilever, Wageningen University, ISPT.

Public Summary

The central goal of this project was to close the circle in food waste streams through designing an innovative processing strategy using high value vegetable waste for the production of high quality and fully natural food ingredients, in the form of dried products with extended shelf life. White Asparagus was identified as the ideal candidate crop to demonstrate the potential of reuse of waste streams where the currently extensive waste stream is exploited to develop new, innovative drying strategies. Importantly, these strategies have to maintain focus on maximum flavour in the final dried powder(s), which are to be used as a clean-label food ingredient to replace current ingredients such as artificial flavouring additives.

In this project processing strategies developed were evaluated for generic applicability to other vegetables (in this case bell pepper). Spray drying in combination with a split-stream processing approach (processing fibre and juice separately after grinding and centrifugation) was successfully proposed and investigated for preparation of asparagus powders with improved flavour profile. Spray drying appeared well suitable to efficiently retain most flavours thanks to its extremely fast drying time. In first instance only the juice fraction was used to prepare spray-dried powder ingredients, but also the fibre fraction was investigated for further processing e.g. to act as a carrier being an alternative for maltodextrin. The split-stream processing approach was also investigated for preparing bell pepper powder, which seemed promising as well for making a flavour-rich powder although the colour pigments were lost during filtration.

Sensory analysis showed that the spray-dried asparagus powder is a very interesting alternative to the traditional available asparagus powders (with artificial flavouring). Teboza and Unilever intend to further investigate this business case. Advanced metabolomics analyses of the starting material (in this case fresh asparagus and waste cut-offs) and the processed materials, often combined with sensory evaluation shed light on the composition of metabolites and flavour compounds in different asparagus varieties and in asparagus harvested during the complete season. Additionally, analyses showed which flavour compounds are affected during concentration and further processing by drying and were thus used to steer the process development. The processing route developed here using spray drying is factor 5-10x more energy efficient compared to more traditional freeze drying, which is often chosen for producing high quality powders. However, the most important energy saving is the potential to convert large amounts of vegetable by-streams (representing an embodied energy 1 GJ/ton) into high quality products with the proposed process.

There has been an excellent on-going collaboration between the two academic teams (resulting in several joint papers) and interaction with the companies (supply of vegetables & sensory studies) to develop new vegetable powders with improved flavour profile. Besides confirming the contribution of previously reported key asparagus odorants (e.g. dimethyl sulphide), the jointed studies also have proposed the importance of other compounds (e.g. 2-methoxy-3-isopropyl pyrazine and 1-octen-3-ol) and have suggested new compounds (e.g. octanal, 1-hexanol) the right intensity of which plays a role in the ‘asparagus’ flavour and should be considered in further studies.