General information	
PPP-number	AF-17102a
Title	Clean Label ingredients (Mild technology for obtaining functional and clean label ingredients from agricultural co-products)
Theme	
Implementing institute	WFBR
Project leader research (name + e-mail address)	Marieke Bruins (Marieke.Bruins@wur.nl)
Coordinator (on behalf of private partners)	Teboza
Project-website address	**https://topsectoragrifood.nl/project/af-17102a-mild-technology-for-obtaining-functional-and-clean-ingredients-for-agriculture-co-products/**
Start date	1 December 2017
Final date	31 march 2020

Approval by the coordinator of the consortium The final report must be discussed with the coordinator of the consortium. The "TKI's" appreciate additional comments concerning the final report.	
Assessment of the report by the coordinator on behalf of the consortium:	X Approved □ Not approved
Additional comments concerning the final report:	

Consortium	
Mention any changes in the composition of the project partners:	No changes

Summary of the project	
Problem definition	Initiatives from food manufactures focus on the optimal use of protein and flavor-rich co-products. As for flavors there are already some products on the market where artificial flavors are replaced with natural source alternatives, for example turmeric, paprika and annatto for macaroni and cheese products from Kraft Heinz. This project focusses on technology to produce functional and clean label ingredients from food products and its co-products. In order to do so, the applied technology is mild and uses the natural crop or co-product which can thereby be cleanly labelled.
Project goals	This project aims at gaining functional powders since for most applications powders are best suited. The process of water removal however should not lead to losses in functionality and valuable components and therefore requires mild technology. Within this project the crop asparagus and the co-product from cabbage and lettuce processing are used as example. Asparagus powder can be added to food products like ready-to-eat meals, soups

	and sauces for increasing flavor and taste. Cabbage contains precursors of flavor components that may be isolated from cabbage co-product and used in ready-to-eat meals. Furthermore, it is expected that cabbage contains various Sulphur-containing secondary metabolites with anti-oxidant, anti-inflammatory and even anti-carcinogenic properties

Results	
Planned results in the original project plan	- List of potential health promoting components and flavor precursors from cabbage processing co-products; - Production of cabbage and/or lettuce flavor concentrate and asparagus product for evaluation of four mild drying technologies and benchmarking with existing commercial products (task 1); - Product specifications of end-users in relation to powder and flavor properties and composition (task 2); - Evaluation of the business cases (task 3); - Production of ample material for evaluation by end-users (task 4); - Quotations for industrial plant.
Achieved results	- White cabbage contains interesting antimicrobial components. However, experiments with pressed juice from white cabbage did not show significant antimicrobial activity. - Cost analysis showed that valuable components in lettuce are present in a too low concentration for profitable isolation - Possible processing routes for clean label asparagus flavour have been identified and tested and are ready for upscaling - Asparagus powder produced by different routes has been tested in a consumer panel - Different drying routes (freeze and atmospheric) have been tested for asparagus drying - A techno-economic assessment has been executed for the processing of asparagus.
Explanation of changes relative to the project plan	No major changes

What was the added value created by the project for:	
Participating "Knowledge Institutes" (scientific, new technologies, collaboration)	Knowledge generation on mild dewatering technologies to preserve flavours including different drying technologies (freeze drying, modified air drying).
Participating private partners (practical application of the results, within which period of time?)	Practical application of process routes for mild dewatering and the effect of the selected process on the quality (taste, flavour) of the concentrated and dried product. Next step is processing on demonstration scale.

Society (social, environment, economy)	Production of a natural product powder without artificial ingredients at mild conditions (less energy consumption). Less food waste by using 'waste product' as feed material.
Possibly other stakeholders (spin-offs)	Selected process routes for mild dewatering and drying are generic and might be useful for other products.

Follow-up	
Did the PPP result in one or more patents (first filings)?	No(t yet)
Are there any follow-up projects planned? If yes, explain. (Contract research resulting from this project, additional funding, or new PPP projects)	A project for upscaling to demonstration scale is considered. In the meantime, there are two PhD projects started as a follow-up wat Wageningen University.

Deliverables/products during the entire course of the PPP (provide the titles and/or a brief description of the products/deliverables or a link to a website.
Scientific articles:
External reports: A. de Jong, M. Bruins, Interesting components from iceberg lettuce and white cabbage, Wageningen Food & Biobased Research Wageningen, January 2019, Report number: 1876 M. Bruins, R Creussen, Mild processing of asparagus residues, Wageningen Food & Biobased Research Wageningen, in preparation.
Articles in professional journals/magazines:
(Poster) presentations at workshops, seminars or symposia.
TV/ radio / social media / newspaper:

Remaining deliverables (techniques, devices, methods, etc.): Process design for mild processing of vegetable residues Mild drying and dewatering techniques

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