

PPP Project Annual Report 2018

The PPP-projects that have been established under the direction of the top sectors must submit an annual report on their technical and financial progress. This format is to be used for reporting the technical progress. A separate format ('PPP final report') is available for PPP-projects that have been completed in 2018.

The annual reports will be published in full on the websites of the TKIs/top sector, excluding the blocks 'Approval coordinator/consortium' and 'Planning and progress' . Please ensure that no confidential matters are left in the remaining blocks.

The PPP Project Annual Reports must be submitted by 15 February 2019 to Hans van der Kolk

General information	
PPP number	AF17014
Title	CULTURED
Theme	Gezond en veilig
Executive knowledge institution(s)	Wageningen Food & Biobased Research TNO
Research project leader (name + e-mail address)	E.P.J. Beckers Erwin.beckers@wur.nl
Coordinator (on behalf of private parties)	Tadgh O'Sullivan (Heineken)
Government contact person	n.a.
Total project size (k€)	4000
Address project website	n.a.
Start date	01.01.2018
End date	31.12.2020

Approval coordinator/consortium

The annual report should be discussed with the coordinator/the consortium. The TKIs appreciate being informed of possible feedback on the annual report.

The coordinator has assessed the annual report on behalf of the consortium:	<input checked="" type="checkbox"/> approved <input type="checkbox"/> rejected
Possible feedback on the annual report:	None

Short content description/aim PPS

What is going on and how is this project involved?
What will be delivered by the project and what is the effect of this?

CULTURED is a multidisciplinary public-private partnership (PPP) which aims to develop novel solutions for the food industry by using natural fermentation strategies. The project will deliver high throughput systems as tools for the discovery of novel food and ingredient functionalities obtained by fermentation. In addition, this project will provide the required technological know-how and will close knowledge gaps to allow the application of fermentation technology in modern food production.

In the end, it is foreseen that CULTURED will expand the application of fermentation in food production to include food products that are currently not standard beneficiaries of microbial intervention. In addition, targeted use of fermentation technology for specific food functionalities will be more easily implemented by the food industry. By establishing the enabling tools and technologies and by creating the toolbox required, CULTURED advances the use of fermentation technology for the discovery and development of minimally processed, wholesome, and sustainable ingredients and products. More importantly, the novel use of fermentation technology

within clean labelling widens the possibilities for product development within this field.

Bringing together fermentation and high throughput screening for specific food functionalities within the framework of clean and clear labelling advances the state of the art in many ways. Firstly, the knowledge of microorganism-food substrate combinations resulting in specific functionalities in food products will be extended. New combinations of microorganisms and substrates resulting in novel functionalities will also be identified. Secondly, high throughput screening will alleviate the constraints of process development that are based on fermentation technology. Thirdly, within CULTURED, fermentation technology will be established for food products on the basis of functionality requirements.

Planning and progress (if there are changes to the project plan, please explain)

Is the PPP going according to plan?	Yes
Have there been changes in the consortium/project partners?	Yes, the company Hamilton Bonaduz AG (Switzerland) would like to join. Consortium partners have agreed. Formalisation of participation is ongoing.
Is there a delay and/or deferred delivery date?	No
Are there any substantive bottlenecks?	No
Are there any deviations from the projected budget?	Yes. Budget is on schedule, but the participation of the new partner will increase the workload. A request will be made for matching additional TKI-funding (budget from the year 2020).

Results in 2018/ so far

Give a short description of the high-lights and (most important) project deliverable in 2018 / so far and their target group

The work in the first year was mainly dedicated to the development of high throughput (HTP) screening methods. Key indicators differed for the five desired functionalities. Initial work was done on defining the fermentation conditions for substrate-microorganism combinations leading to specific functionalities and application. A large variety of substrates provided by industrial partners was screened on fermentability.

Low caloric sweeteners

An existing receptor-based screening assay for sweetness was investigated for its ability to detect sweetness of natural sweeteners. We performed initial experiments with different amounts of two low-caloric sweeteners know to be produced by microbial species and compared the response with the response for sucrose. Both low-caloric sweeteners were detected in a dose-response manner, which showed the suitability of the receptor-based screening assay to detect "new" sweeteners. In additional experiments, detection of one low-caloric sweetener as a model compound, in fresh and spent complex medium was investigated. Next steps will be the detection of other commercially low-caloric sweeteners.

Additionally, the production of the model sweetener by yeast strains was initiated as a show case to setup fermentation processes for the conversion of selected industrial substrates in food ingredients. Ethanol was found as side product with all substrates applied, but the amount could be considerably decreased using controlled conditions in the reactor.

Anti-microbials

Indicator for the anti-microbial property of a fermented substrate should be the resistance against three well-known food pathogens. Work was done to develop a method in which these three organisms can simultaneously grow as a mixed culture without noticeable influences on their individual growth performance. Such is observed by determining their increase of DNA content via a multiplex quantitative PCR (qPCR). At the end of the year, all three target food pathogens could be detected and quantified and high throughput screening of antimicrobial functionality was ready for use.

Additionally, the effect of partner substrates "as is" on growth of pathogens was determined. Raw materials with a natural anti-microbial effect will be excluded from further high throughput

screening.

Umami/kokumi enhancers

Existing production methods of umami/kokumi (umakoku) compounds have been analysed as a starting point to produce umakoku compounds within Cultured. Next, the freedom to operate within/around these technologies has been explored in tight coordination between the knowledge institutes and the industrial stakeholder(s) within Cultured. Concurrently, a detection method suitable for the most common umakoku compounds has been developed based on available literature. This method is currently being used to select the most promising method of umakoku production within Cultured. Several potential approaches are currently under investigation and this work will be continued in the second year of the project.

Aromas

Investigated was which analytical method (liquid versus different types of headspace measurements) would be most suitable for a high throughput screening of aromas. In order to find the best method, dozens of reference aroma compounds were received from a partner and analysed under different conditions. Finally, a decision was made for the most suitable method for analysing the desired compounds. A target library is built up in order to enable identification of target aroma molecules in ferments. Additionally, work is done to optimise conditions and semi-automated compound identification.

Texturisers

Analysis of (high throughput) methods for determining texturising properties of a ferment has been investigated. The focus of the HTP method is to determine two distinct textural properties. These textural properties are (1) improvement of mouthfeel and (2) gelling properties of ingredients for specific applications. Currently, the most suitable method is now being developed. Validation experiments were done to establish the correlation between the method chosen and specific rheological properties within the texturising functionality. Each application will require a unique approach.

Improvement in mouthfeel. Work is ongoing on establishing proof of principle that an increase in the measured indicator will result in an improved mouthfeel in specific food applications. A trained sensory panel will be used in year 2 as a direct evaluation of improved mouthfeel over instrumental methods.

Gelling properties. In year 1, benchmark products have been characterised and the desired rheological profiles required have been identified. Due to the complex rheological properties of the selected applications, the possibility of correlating the complex modulus of fermented samples with the chosen indicator is being explored. Additionally, rheological properties of existing substrates were characterised to establish baseline data.

In both cases (improvement of mouthfeel and gelling properties), small scale fermentations have been started as proof of principle for modifying (improving) properties of a few substrates. Specific targeted fermentations are planned for the texturizing functionalities.

Microbial fatty acids

At the end of the year, a sixth functionality was added to increase added value of biomass utilisation. This will be a dedicated approach for the production of microbial fatty acids from side stream products of partners Duynie and GPC. Work on this functionality will start in Q2 of 2019.

Regulatory framework surrounding Fermentation technologies

Finally, an intensive study was performed on important aspects related to regulatory issues which might favour or limit the introduction of (newly) developed ferments as food ingredients. The European regulatory framework related to novel foods, food labelling, food safety, down-stream processing and fermentation were reviewed within the context of CULTURED objectives (developing multi-functional, clean label ingredients using fermentation). Current analysis indicate that EU regulations related to fermentation is fragmented and can be found in a wide array of separate regulations. As a result, there is a lack of comprehensive implementing rules or guidance on the use of fermentation technology in food applications. We are currently compiling relevant regulations affecting the use of fermentation for food applications. This report will serve as a useful guide to the agri-food industry at large.

Number of delivered products in 2018 / so far *(in an appendix, please provide the titles)*

<i>and/or description of the products or a link to the products on public websites)</i>			
Academic articles	Reports	Articles in journals	Introductions/workshops
--	--	--	December 2018 - workshop with all partners

Appendix: Names of the products or a link to the products on a public website

N.a.