

# Fermentation to add value to plant by-product streams

Centre for Food Processing and Packaging & Centre for Food Safety and Quality Management



From left: **Ramona Rüegg, Pius Meier, Nadina Müller, Susanne Miescher, Sandra Schwenninger, Sandra Mischler**

**Contact**  
**Dr. Nadina Müller**  
Head of Food Technology  
Research Group,  
mun@zhaw.ch

**Research project**  
**HiViscoFerm – highly viscous fermentations for the food industry**

**Head:**  
Dr. Nadina Müller, Susanne Miescher, Sandra Schwenninger

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**Water means life. At the same time, however, water is an important cost driver in the processing of food. Fermentation is a process step with great potential to facilitate the adding of plant by-product streams to the food value chain, thereby avoiding food losses. New concepts for the fermentation of grain by-products with minimal water content should make it possible to achieve an optimal product in terms of food quality and safety.**

The principle “water means life” also applies to microorganisms and is a central factor in fermentation processes. Methods of fermentation have great potential in connection with the further processing of plant by-products such as wheat bran, barley flour or legume husks into food.

## Use of protective cultures

The use of functional microorganisms, in particular in the form of protective cultures, is becoming increasingly important and, in addition to the positive influence on the sensory profile,

makes it possible to inhibit the growth of undesired microorganisms and to reduce the mycotoxins which (may) have already formed in the product. The latter are an important topic, especially with respect to grain by-product streams. Of the 142 million tons of wheat bran produced each year, around a quarter are contaminated with mould resulting from unfavorable weather conditions before the harvest, or improper storage conditions. These, in turn, can form mycotoxins, which are extremely difficult to remove from the product.

## Cost efficiency in processing

On the other hand, water is often one of the main cost drivers in the processing of food. This is especially true if the product is then dried again to extend its shelf life. Precisely when it comes to valorising by-product streams, cost-effective processing is of the utmost importance. In spite of exciting additional functionalities, the resulting products are usually compared in terms of price with cheap, basic, raw materials such as flour, and tend to be sold in dry, powdery form.

## Fermentation with minimal water content

The present collaboration between the Food Biotechnology Research Group and the Food Technology Research Group is focussed on the matter of fermentation with minimal water content. In the first project

phase, laboratory screenings were used to determine the minimum water content required to allow metabolic activity of fermentation-relevant microorganisms. The findings were transferred to a state-of-the-art solid fermenter to verify the results. This was followed by an analysis of the characteristic product properties with correspondingly low water contents. In particular, the properties relevant to processability were evaluated. Based on these findings, it was necessary to develop new fermenter concepts to enable the cost-effective production of fermented grain by-products as well as the scalability of the fermenters to the ton scale.

## Goal: sustainable grain processing

In the next project phase, these concepts were tested and refined using prototypes, and microbial cultures for the fermentation of grain by-product streams were further optimised. In the future, the interplay between optimised crops and new fermentation concepts should allow the manufacture of products that are attractive in terms of their sensorial properties and of perfect quality, thus making the grain processing chain more sustainable. ■



Fig. 1: Fermentation of wheat bran in a solid fermenter to verify the minimum necessary water content which allows metabolic activity of fermentation-relevant microorganisms.

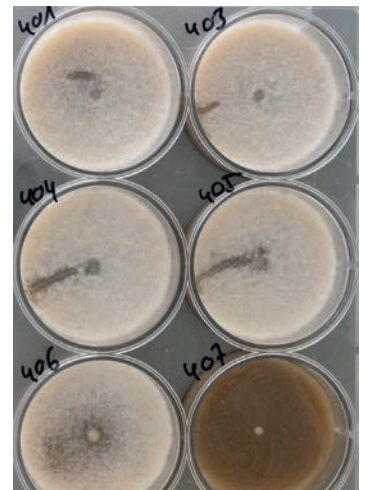


Fig. 2: Added value through antifungal lactic acid bacteria, visible in the strong inhibition of mould growth on the lower right.

## Design of a cocoa aroma reference kit



**Dr. Irene Chetschik**  
Head, Research Group  
Food Chemistry,  
chet@zhaw.ch



**Karin Chatelain**  
Research Associate,  
geka@zhaw.ch

When it comes to understanding cocoa or chocolate aroma, appropriate tools are necessary. For this reason, a cocoa aroma reference kit has been developed in collaboration with the Swiss Chocolate Panel, with the purpose of being used as a tool for training and calibration of sensory panels. Although sensory reference kits for products such as wine, other alcoholic beverages and coffee are already on the market, our reference kit is the first targeting cocoa aroma and will be available via our home page soon. The reference kit has already been successfully applied in sensory trainings of cocoa producers in the countries

of origin and also for the establishment of the gas-chromatography olfactometry panel at the ZHAW Institute of Food and Beverage Innovation. Additionally, it is planned to use this tool in education formats, such as ZHAW sensory chocolate tasting courses as well as the science week, and whenever it is easier to experience cocoa aroma than to explain it. ■



Fig. 1: Picture of selected aroma reference compounds of the kit. The labels were designed in collaboration with the graphic designer Sylvie Lüscher (Sylvie.ch).

## Food contact material course



**Barbara Beck**  
Research Assistant,  
bekb@zhaw.ch



**Selçuk Yildirim**  
Head, Centre Food  
Processing and Packaging,  
yise@zhaw.ch

Increasing trade between the EU/Switzerland and China has led to a growing interest in understanding the differences and similarities in food contact regulations in both areas. In collaboration with the National Reference Laboratory for Food Contact Material in China and the Swiss Quality Testing Services a new training course will be organized at ZHAW Wädenswil. The course will provide insights about food and packaging technologies, and help to improve the understanding of the link between food contact regulations and packaging applications. Particular emphasis will be given to compare food contact material regulations in the EU with those in China. Additionally, the lectures will cover migration topics and sustainability approaches for food contact materials. The course is especially designed for people from food or packaging companies involved in exporting/importing goods between the EU and China, as well as those who are interested in the differences and alignments between the food contact material legislations in the EU and China.

[zhaw.ch/ilgi/fcm-eu-cn](https://zhaw.ch/ilgi/fcm-eu-cn)

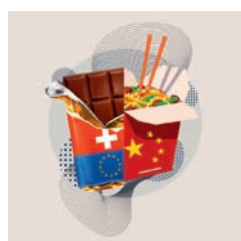


Fig. 1: Training course for "Food contact material legislation in Europe/Switzerland and China – Differences and Alignments"

## Authorisation of Novel Foods in Switzerland



**Dr. Evelyn Kirchsteiger-Meier,**  
Head, Centre for Quality  
Management and Food Law,  
meev@zhaw.ch

Since 1 May 2017, the regulatory provisions pertaining to novel foods have been in force in Switzerland; this is due to the entry into force of the comprehensive regulatory overhaul of Swiss food legislation. Novel foods are defined in Art. 15 of the Ordinance on Foodstuffs and Utility Articles (FUAO; CC 817.02) [1]; these are foods that were not used for human consumption to a significant degree within Switzerland or a member state of the EU before 15 May 1997 and which fall under one of the categories in Art. 15 para. 1 FUAO. According to Art. 16–17 FUAO, these foods are subject to authorisation which is regulated in the Ordinance on Novel Foods (CC 817.022.2) [2]. The Federal Food Safety and Veterinary Office (FSVO) grants the authorisation if the safety of the foodstuff and protection against deception are guaranteed, which must be proven by the food business operator.

Therefore, if a food in question has not already been approved as a novel food the novel food status must be established, i. e. it must be determined whether the food falls under the regulations for novel food, or not. The Centre for Quality Management and Food Law supports companies in this step, which – depending on the type of product – can be a demanding undertaking. In addition, the Centre also assists in the

preparation of applications for approval, considering the legal and other requirements (e. g. publications of the European Food Safety Authority, EFSA).

One example concerns the bulb of the David's lily (*Lilium davidii*), which has long been part of Chinese cuisine and is now planned to be marketed in Switzerland. The Centre for Quality Management and Food Law supported the food business operator in the development of the dossier regarding determination of the novel food status as well as the actual application dossier; also in the context of a student project. The FSVO has recently classified this product as a traditional novel food according to Art. 15 para. 1 let. k FUAO; the substantive assessment of the application is still in progress. (Status: January 2020). ■

[1] Ordinance of 16 December 2016 on Foodstuffs and Utility Articles (FUAO), CC 817.02; Status on 15 October 2019.

[2] FDHA Ordinance of 16 December 2016 on Novel Foods, CC 817.022.2; Status on 1 May 2018. Abbreviations: CC Classified Compilation [of Swiss federal legislation]/FDHA Federal Department of Home Affairs



Fig. 1: Freshly harvested lily bulbs for food purpose in China.