

Master of Science HES-SO in Life Sciences

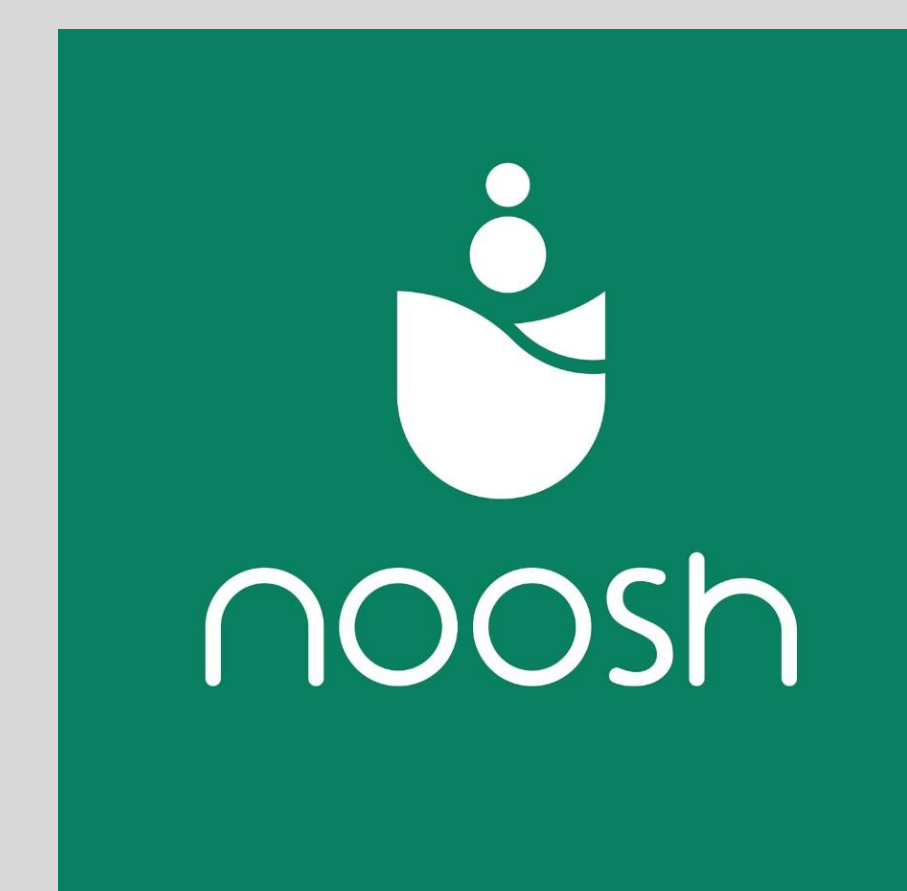
Characterization of Kefir Fermentation and Evaluation of Potential Bioprocess and Flavor Improvements

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DESCRIPTION

During the COVID-19 pandemic, there was an increased interest in natural products that could improve consumers' health. **Fermented products** such as milk and **water kefir**, as well as kombucha, were discovered by many as having beneficial effects. Specifically, **water kefir**, which has gained significant attention among people seeking to adopt a plant based or vegan diet or those with milk protein allergies or lactose intolerance. Additionally, scientific research has revealed the potential health benefits of consuming drinks made from water kefir. Indeed, this easy homemade fizzy beverage has a significant probiotic content, which are important for the human's gut, and which plays a role in every aspect of health.

Noosh Drinks, an on-going start-up, decided to make their own kefir drink. Their goal is to bring the production of kefir-based drinks to a new level by introducing innovative techniques while continuing the scientific research and development. By promoting the consumption of water kefir drink, **Noosh** will contribute to the improvement of overall health and well-being in the society. This project helped **Noosh** to optimize their production process and to better understand the key parameters to improve reproducibility of their drinks, while also thinking of increasing the volume of production.



OBJECTIVES

There are different aims in this study, starting by understanding the fabrication process of **Noosh** drinks. This has been achieved during X02 project and a first **Standard Operating Procedure (SOP)** has been written.

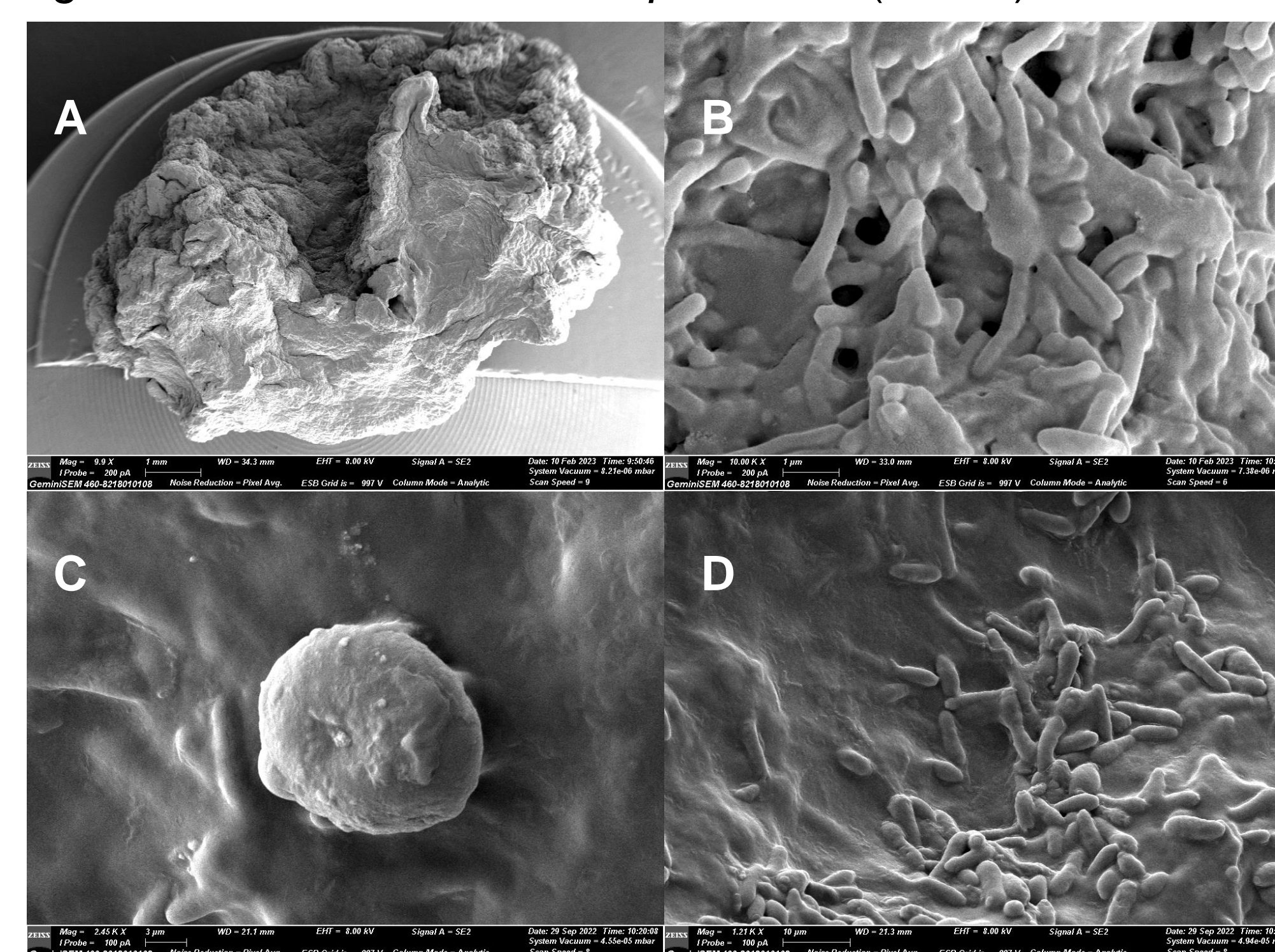
Some interesting results will be presented to explain the first optimization done in X03. To continue in this sense, another goal is to obtain a **robust** and **optimized** bioprocess of two fermentation steps to get at the end a reproducible and stable drink with the desired taste. To assess that, key parameters will be measured (i.e., sugars, lactate, acetate, and ethanol content) and some first sensory analysis will be done. A study of **scalability** will be achieved for future higher volume production.

On the other hand, to obtain a stable product, it is mandatory to have a stable and well-known ingredient at the beginning: the kefir grain. A first **microbiological characterization** of the grain will be presented and compared with existing studies.

RESULTS

Water Kefir Grain

Water Kefir Grain (A) are a symbiotic culture of bacteria and yeast in a polysaccharides matrix. Those grains are mainly composed of *Saccharomyces cerevisiae* (C), lactic acid bacteria, such as *Lactobacillus hilgardii* and *Lactocaseibacillus paracasei* (B & D) and acetic acid bacteria.

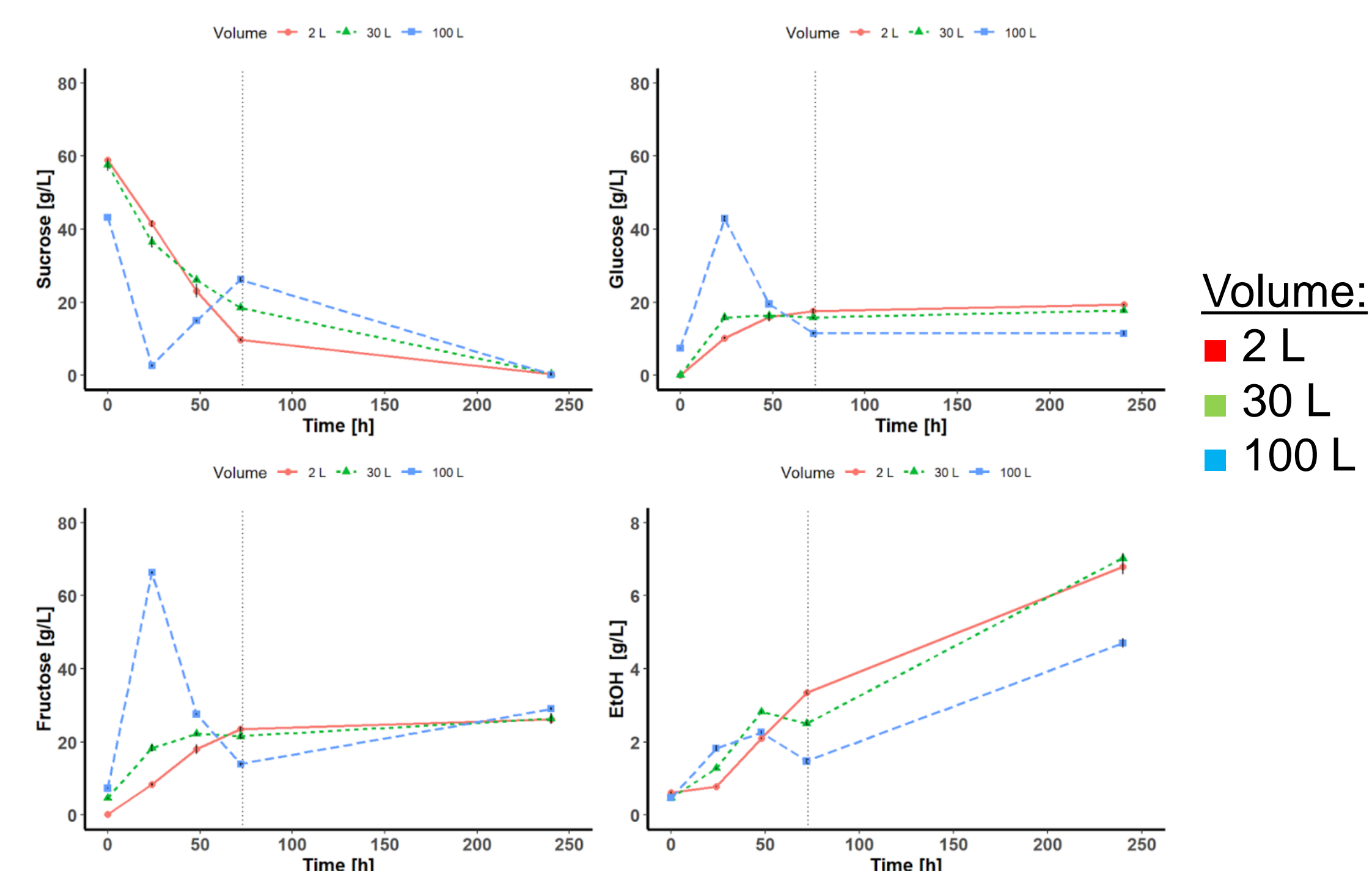


SEM Picture of Water Kefir Grain

Those microorganisms are living in harmony, for example the sucrose is hydrolyzed by the yeast into glucose and fructose which are then available for the bacteria. Yeasts' metabolism provides also the peptides and amino acids from the fruit's proteins.

Process and Scale-Up

A comparison of three different **volumes** (2, 30 & 100 L) has been made. The measure of Sucrose, Glucose, Fructose and Ethanol showed differences in terms of Sucrose consumption during the culture when the sugar is faster hydrolyzed in smaller volume increasing the Ethanol content. During the tasting, no changes have been observed showing the **possibility of scaling-up the process**.



Measurement during scale-up

CONCLUSIONS

With the collaboration with **Noosh Drinks**, the project demonstrated the manufacturing potential of this probiotic, healthy drink. Multiple experiments, using design of experiment, helped to identify the key parameters for a stable production of the drink. Those parameters have been tested on a first scale-up (100 L) and a future larger tasting event will help confirm the excellent taste of the drinks. New aromas have been tested and implemented with the help of tasting events done during this Master Thesis.

A first **biological characterization** of the water kefir consortium has been performed. The presence of typical yeast (*Saccharomyces cerevisiae*) and lactic acid bacteria (*Lactocaseibacillus paracasei* and *Schleiferilactobacillus harbinensis*) has been demonstrated in adequation to previous studies. Future microbiological tests still need to be done to fully characterize the grain, also during growth.

There are still many questions to be asked concerning a **higher scale of production, storage of the bottles or the expiration date and food safety control**.