The use of Acid Whey for the Cultivation of Kefir Grains: Laboratory Optimization and Transfer of the Process to the Pilot Scale

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INTRODUCTION

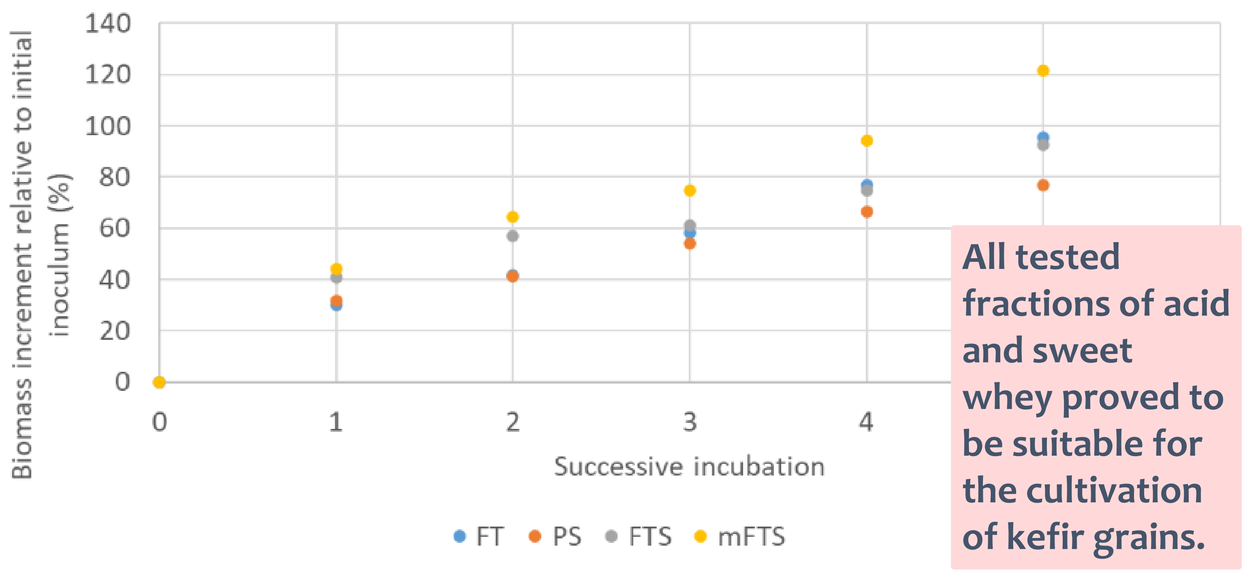
Kefir grains are complex groups of lactic acid bacteria, yeasts, and sometimes acetic acid bacteria in a polysaccharide-protein matrix. As a natural starter culture in a suitable growth medium, they perform fermentation where they break down the sugars present in the medium. Milk is most frequently used as a growth medium, but whey, especially sweet, has also been tested. After selective isolation of whey proteins, which has been carried out within the project LIFE for Acid Whey, all lactose and other nutrients that are essential for the growth and development of microorganisms remained present in whey. Due to the presence of many microorganisms, metabolites, and various bioactive substances produced during fermentation, as well as many positive effects on human health, kefir grains and whey represent great potential in the development of functional foods and food supplements. The purpose of our study was to optimize the cultivation of kefir grains to achieve maximum growth of kefir biomass at the laboratory and pilot-scale using whey residues from previous processes and thus contribute to reducing whey waste and negative environmental impacts.

OPTIMIZATION OF THE CULTIVATION OF KEFIR GRAINS AT THE LABORATORY SCALE

- Defining the optimal growth conditions of kefir grains in whey.
- Maintenance of inoculum stock of kefir grains by successive fermentations.
- Defining the optimal method of activating the frozen stock of kefir grains at -18 °C.

Optimization of effects on biomass growth:

- growth medium preparation,
- initial pH value,
- inoculum proportion,
- duration of incubation,
- temperature of incubation,
- selection of culture medium by testing different fractions of whey that remained in the procedures of selective isolation of whey proteins.



All tested fractions of acid and sweet whey proved to be suitable for the cultivation of kefir grains.

Figure 1: *Comparison of the increase relative kefir grain biomass, calculated on the initial inoculum of kefir grain cultivation in different media:*
- *FT and PS of acid whey,*
- *FT of sweet whey (FTS) and*
- *FT of sweet whey with adjusted lactic acid content (mFTS).*

TRANSFER OF KEFIR GRAINS CULTIVATION TO THE PILOT SCALE

	LABORATORY SCALE	PILOT SCALE
KEFIR GRAINS INCUBATION		
DRAINING OF KEFIR GRAINS		

Comparison of kefir grain cultivation at laboratory and pilot scale

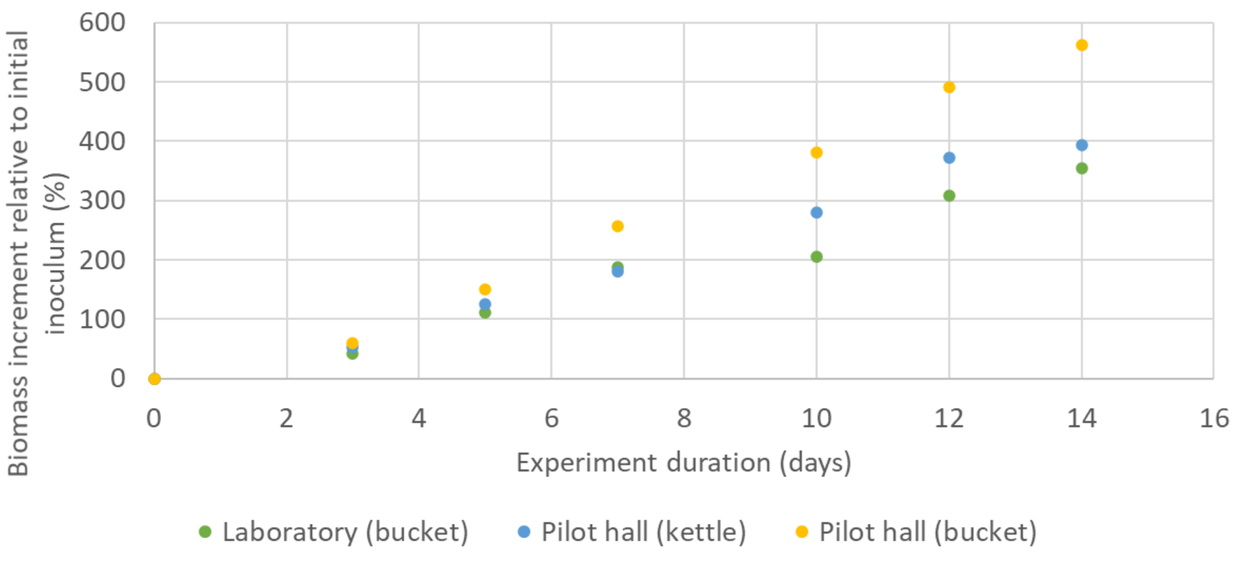


Figure 2: *Comparison of kefir grain biomass growth rate, calculated according to the initial inoculum at laboratory and pilot scale.*

Comparable growth trend of kefir grains at laboratory and pilot scale → successful transfer of kefir grain cultivation to pilot scale.

CONCLUSIONS

The results in our study show that acid and sweet whey residues are suitable growth mediums for the cultivation of kefir grains with the aim of using kefir grains and growth medium for the formation of new functional foods and food supplements. The highest growth rate of kefir grains was achieved in whey fractions with a previously removed initial starter culture of lactic acid bacteria, deproteinized, and with adjusted pH value. The experiment of comparing the growth of kefir grains at the laboratory and pilot scale has shown that the optimized process of kefir grains cultivation at the laboratory scale can be transferred to the pilot scale.

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