Effect of fermentation conditions and thermal treatment on the formation of kefiran and the rheological behavior kefir

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Objective:
The aim of the present work was to investigate the effect of inoculum, pH at the end of fermentation and thermal treatment post fermentation on the production of kefiran and the rheological properties of kefir.
Methods:
Bovine full fat milk and traditional kefir grains were used for kefir preparation. The milk was heat-treated, at 90C for 5min, cooled down at 30C and inoculated with different kefir grains concentrations ranging from 3 to 30%. Subsequently, fermentation was allowed at 25C until pH 4.4 or 5.5, and the resulting samples were transferred at 4C with or without the grains used for the fermentation. Kefir samples strained immediately after fermentation were placed for 24 h at 4C and then further analyzed for their kefiran content and rheological behavior. Kefir samples together with the kefir grains used in the fermentation were stored at 4C for 3, 7 and 15 days. At the end of the storage time the grains were strained and the resulting kefir samples were further analyzed. Moreover, inoculated heat-treated milk samples with different concentrations of kefir grains were stored at 4C, without fermentation, for 15 and 30 days before grain removal and analysis of the sample properties as mentioned above.
The exopolysaccharide kefiran was isolated to high purity using trichloroacetic acid for protein removal and three successive ethanol precipitation steps. The apparent viscosity and viscoelastic properties of the samples (dynamic analysis and creep test) were evaluated using a DMA rheometer, Bohlin C-VOR 150.
Results:
Kefir grain concentration affected kefiran production irrespective of the final fermentation pH, or the time allowed to ferment at the ambient temperature of 25C. Increasing kefir grain concentrations favored kefiran production and improved the rheological properties, apparent viscosity and viscoelasticity. Intensive low-temperature thermal treatment conditions, such as long term storage in the presence of kefir grains also resulted in increasing kefiran concentrations and favored the rheological properties of kefir samples. Fermentation and final pH values affected the above mentioned properties to a lesser extent.
Conclusions:
Proper selection of fermentation conditions and thermal treatment of kefir can increase kefiran production and reinforce viscoelasticity of its protein matrix.