Development, Optimization and Quality assurance of Sysskonhem AB Ginger Beer Process

There have recently been an increased demand on handcrafted beverages. In this project, a design for an safe and efficient scale up of the ginger beer production process from the existing 200L batches to productions of up to 2000L per batch are provided and evaluated in regards to safety, quality and flavor of the product. This is essential for meeting the increased demands but also for solving troubles with the quality of the product such as proceeded microbial activity in the bottles after bottling.

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Three major areas of challenge were investigated throughout the projects. First, the ability of infusing the substantially larger volumes of ginger beer with flavor from fresh ginger and lemon – without having unnecessary steps of processing. Second, to obtain a sufficient pasteurization process to reduce the microbial activity in the product to safe levels. And third, to protect the pasteurized product from the surrounding background microbial burden disturbance from the brewery environment.

The first challenge was investigated by providing a new infusion unit to the process. This unit was a smaller tank (200L) connected to the main fermenter tank. By having all ingredients in the smaller tank and circulating the beverage from the smaller tank through the large tank and back during the initial 48h of the process, an efficient flavor infusion was enabled and an easy separation of the ingredients from the beverage after terminating the infusion was applied. The efficiency of the flavor yield was tracked by measuring the [6]-gingerol content (most pungent component in ginger) using HPLC.

The second challenge was investigated by performing small scale pasteurization experiments in varying time and temperature conditions on ginger beer samples. Further, UV treatment was tested as an alternative to traditional thermal pasteurization.

To investigate the background microbial burden in the brewery, the third challenge, microbial settling plate analysis were performed before, during and after running the malt milling machine in the brewery.

The result given of a long series of analyses were that the flavor extraction of ginger was efficient in regards to extracted [6]-gingerol, and therefore the new infusion equipment was efficient. However, it was shown that addition of ethanol in the extraction media surrounding the ginger enhanced the extraction rate. In the pasteurization analysis, a sufficient microbial reduction ($5\log_{10}$) was provided at 75˚C for 20min. However, UV treatment showed at least as efficient reduction as traditional thermal pasteurization. UV treatment have the advantages of less energy usage and being a more humble processing step to the product. In the background microbial burden analysis of the brewery environment it was shown that high levels of microbial background disturbance, with high numbers of *lactic acid bacteria, yeast and moulds* and *aerobic microorganisms* where present. Further it was shown that during milling the background levels (CFU/m^2) of these organisms increased from low to about 10^5,

indicating that sensitive products needs to be protected from the general environment in the brewery.

The findings provided in this thesis will help Sysskonhem AB to further implement a developed and optimized process design for their ginger beer, suitable for volumes up to 2000L. Furthermore, different solutions to the step of microbial reduction to provide a safe final product is presented. UV-treatment is an interesting alternative in regards to energy savings and lower costs in the long term. The final product needs to be protected against the general environment in the brewery, therefore the milling machine cannot be ran in close time space to the bottling of produced products. The best solution would be to re-build the brewery with the milling machine secluded in one room with good ventilation.