Studying yeast invertase substrate specificity in the context of wheat dough fermentation

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- *Investigate the variation in yeast invertase activity towards different fructose-based substrates*
- *Studying degradation of wheat grain fructan by yeast invertase*
- *Use of different S. cerevisiae strains in wheat dough fermentation and bread making*

Yeast invertase, the enzyme responsible for degradation of wheat grain fructans, raffinose and sucrose is much more important in bread making than generally recognized, as invertase-mediated release of glucose and fructose account for a significant part of the CO_2 production during the first stage of fermentation. Furthermore, fructan degradation during dough fermentation appears to be very yeast dependent. This variation can be an interesting tool to steer fructan degradation during bread dough fermentation. On the one hand, lowering the fructan content in bread is beneficial for people sensitive to FODMAPs (Fermentable Oligosaccharides, Disaccharides, Monosaccharides and Polyols), including fructans. On the other hand, a higher fructan content can be health promoting since fructan is an easily fermentable dietary fibre and prebiotic.

The aim of this work is therefore to gain more insight in the variation in invertase activity and substrate specificity between different industrial *S. cerevisiae* yeast strains. Different industrial strains were analyzed for their degradation capacity towards different substrates i.e. sucrose (DP 2), fructo-oligosaccharides (FOS, DP 2-8) and inulin with a high degree of polymerization (DP ≥ 23). For this, the invertase-mediated fructose release per minute was determined. Furthermore, their capacity to degrade purified wheat grain fructans was analyzed. The goal of this screening is to select yeast strains that are potentially able to enhance or decrease fructan degradation during fermentation of cereal based products.

Large differences in specific invertase activity on sucrose and FOS were observed between the analyzed industrial strains. Invertase activities on sucrose were varying from 0.190 ± 0.064 U in a wine strain to 1.14 ± 0.057 U in a bio-ethanol strain. Invertase activities on FOS were varying from 0.021 ± 0.003 U in a sake strain and a wine strain to 0.298 ± 0.008 U in a bio-ethanol strain. None of the already investigated strains could grow on or degrade the long inulin chains. Strains with a high activity on sucrose and FOS can potentially be used for enhancing fructan degradation during fermentation. However, further research is necessary to see how these strains deal with wheat grain fructans during dough fermentation. Therefore, these strains will be used in dough- and bread making experiments

and the fructan degradation will be evaluated. Strains that show a very low invertase activity on FOS can be used for the development of bread with a higher fructan content.

In conclusion, the first results of this study show that there is a large variation in invertase activity and specificity between different industrial *S. cerevisiae* strains. This variation can possibly be used for modulating the fructan content of cereal products. Future work is necessary to reveal which (genetic) mechanisms are responsible for variation in invertase activity and specificity. These insights can be used to steer invertase specificity towards the degradation of larger substrates.

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