

Anti-bacterial activity of lysozyme in pitching yeast and effect of lysozyme on yeast fermentation

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Lysozyme has antibacterial activity against Gram-positive bacteria and has no activity against yeast. As such, lysozyme can be used for the specific inhibition of beer spoilage bacteria. After all, the most frequently identified beer spoilage bacteria are lactic acid bacteria and brewers' yeast is the culture used for the fermentation. Hen egg white lysozyme (300 mg/L) is tested for the antibacterial activity against four described Gram-positive beer spoilage bacteria in industrial pitching yeast and in industrial beer with refermentation in the bottle. The influence of industrial pitching yeast treated with lysozyme on the fermentation performance is also studied.

Antibacterial activity of lysozyme in pitching yeast and effect of lysozyme on yeast fermentation

The four studied lactic acid bacteria strains are sensitive to the antibacterial effect of lysozyme. The sensitivity is more pronounced when the yeast suspension is incubated at 22°C. The sensitivity is species dependent. *Pediococcus inopinatus* LMG 11410 is most sensitive (decimal reduction times of 3-10h at 22°C). *Lactobacillus brevis* LMG 16322 and *Lactobacillus brevisimilis* LMG 14527 show a similar sensitivity (decimal reduction times of 8-25h at 22°C). *Lactobacillus lindneri* LMG 14528 is most resistant against the antibacterial activity of lysozyme (decimal reduction times of 40-50h at 22°C). The antibacterial effect of lysozyme is influenced by the characteristics of the yeast slurry (pH, real extract, alcohol content, total cells). After one day incubation at 22°C no negative effect of lysozyme addition on the fermentation performance was observed. Added alcohol during the lysozyme incubation test only had a negative effect on fermentation performance of 8th generation pilsner yeast. For pilsner yeast, also incubation at 10°C was tested since this is applicable to industrial practice. In industry, pilsner yeast is harvested at this temperature and cooled during storage. When lysozyme is added to the fermenting beer (heavy wort or pilsner wort) instead of to the pitching yeast slurry, no negative effect is observed on the fermentation performance in any of the tests carried out. These results confirm those obtained by the incubation of pitching yeast slurry during several days at fermentation temperature.

Antibacterial activity of lysozyme in refermented beer and effect of lysozyme on yeast refermentation

In all series of refermentations of beer of 5.2% alcohol (v/v) with 1.5 million yeast cells/ml beer, the added extract (0.3 °P glucose) was fermented in the three weeks of refermentation.

The four studied lactic acid bacteria strains are sensitive to the antibacterial effect of lysozyme. The sensitivity is species dependent. *Lactobacillus lindneri* LMG 14528 is most resistant against the antibacterial activity of lysozyme. The beer bottles with lysozyme contained no residual bacterial cells after 32 days of contact with lysozyme. Comparable blank series without lysozyme showed good growth for *Lactobacillus brevis* LMG 16322 and *Lactobacillus lindneri* LMG 14528.

The antibacterial activity of lysozyme is clearly most effective for inhibiting growth of bacterial cells.

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