Non-Fusion and Fusion Expression of β-Galactosidase from *Lactobacillus bulgaricus* in *Lactococcus lactis*[1]

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Objective To construct four recombinant *Lactococcus lactis* strains exhibiting high β-galactosidase activity in fusion or non-fusion ways, and to study the influence factors for their protein expression and secretion. **Methods** The gene fragments encoding β-galactosidase from two strains of *Lactobacillus bulgaricus*, wch9901 isolated from yogurt and 1.1480 purchased from the Chinese Academy of Sciences, were amplified and inserted into lactococcal expression vector pMG36e. For fusion expression, the open reading frame of the β-galactosidase gene was amplified, while for non-fusion expression, the open reading frame of the β-galactosidase gene was amplified with its native Shine-Dalgarno sequence upstream. The start codon of the β-galactosidase gene partially overlapped with the stop codon of vector origin open reading frame. Then, the recombinant plasmids were transformed into *Escherichia coli* DH5α and *Lactococcus lactis* subsp. *lactis* MG1363 and confirmed by determining β-galactosidase activities. **Results** The non-fusion expression plasmids showed a significantly higher β-galactosidase activity in transformed strains than the fusion expression plasmids. The highest enzyme activity was observed in *Lactococcus lactis* transformed with the non-fusion expression plasmids which were inserted into the β-galactosidase gene from *Lactobacillus bulgaricus* wch9901. The β-galactosidase activity was 2.75 times as high as that of the native counterpart. In addition, β-galactosidase expressed by recombinant plasmids in *Lactococcus lactis* could be secreted into the culture medium. The highest secretion rate (27.1%) was observed when the culture medium contained 20 g/L of lactose. **Conclusion** Different properties of the native bacteria may have some effects on the protein expression of recombinant plasmids. Non-fusion expression shows a higher enzyme activity in host bacteria. There may be a host-related weak secretion signal peptide gene within the structure gene of *Lb. bulgaricus* β-galactosidase, and its translation product may introduce the enzyme secretion out of cells in special hosts.

Key words: β-galactosidase; *Lactococcus lactis*; Lactose intolerance; Protein expression; Protein secretion.

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