Pasteurization and changes of casein in bovine milk by low-pressure carbon dioxide microbubbles

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Introduction

Recently, low-pressure carbon dioxide microbubbles ($MBCO_2$) technology was developed as a pasteurization treatment. However, $MBCO_2$ have never been applied to bovine milk.

Aim

The inactivation efficiency of $MBCO_2$ on *Escherichia coli* added to physiological saline (PS) and commercial sterilized bovine milk (CBM), and on aerobic bacteria in unpasteurized bovine milk (UBM) was investigated. Furthermore, the quality of the treated milk was analysed by measuring the protease resistance of casein in the milk.

Methods

The PS and CBM with added *E. coli* K12, and UBM were used as samples. The $MBCO_2$ treatment was performed under the following conditions: the temperature and pressure in the mixing vessel were set at 10 °C and 1-2 MPa, respectively, and the temperature, pressure, and exposure time in the heating coil were set at 35-50 °C, 4 MPa, and 1-10 min, respectively. The number of surviving bacterial cells in PS, CBM and UBM treated with $MBCO_2$ was measured by the colony-counting method. The protease resistance of casein was measured by enzyme reaction with papain and thermolysin.

Results

Five-log reduction of *E.coli* populations in PS and CBM was achieved by the $MBCO_2$ treatment. The inactivation efficiency increased with increasing pressure in the mixing vessel, or with increasing temperature in the heating coil. In addition, a 3-log reduction in aerobic bacteria in UBM was achieved by $MBCO_2$ after 1 min with the heating coil at 45 and 50 °C. Casein in UBM treated only in the mixing vessel of $MBCO_2$ was decomposed more easily by thermolysin, although casein warmed with the heating coil was difficult to decompose with thermolysin and papain.

Conclusion

Significant inactivation of *E. coli* in PS and CBM was induced by $MBCO_2$ with the heating coil at 45 and 50 °C, although the inactivation of aerobic bacteria in UBM was limited. In addition, the protease resistance of casein in UBM was changed by $MBCO_2$.