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Rate Analysis of the Sterilization of Microbial Cells in High Pressure Carbon Dioxide

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The sterilization rate for *Saccharomyces cerevisiae* and the spores of *Bacillus subtilis* in a process using high pressure CO_2 was analyzed. The microorganisms were placed in a reservoir, and the pressure was increased to a selected value. The sample was kept at constant pressure and temperature for a certain period. Thereafter, the pressure was decreased and the number of the living cells were determined from the colony count. The time course of the survival ratio for the microbial cells were described as a first order reaction, with the sterilization rate constant k being evaluated. This result indicates that the microbial cells are killed mainly at the constant pressure stage. At constant temperature, the values of k for the microorganisms increased with the increase in pressure and definitely increased near the critical pressure of CO_2. From the Arrhenius plots of k, the values of the activation energy E and the frequency factor A were evaluated, decreasing with the increase in pressure. The orders of the values for E were 10^4 to 10^5 J/mol.

Keywords: sterilization, carbon dioxide, first order reaction, activation energy, *Saccharomyces cerevisiae*, *Bacillus subtilis*

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