

**INVESTIGATION OF OPTIMUM FREQUENCY FOR
NON-HEATING STERILIZATION BY HIGH
INTENSITY PULSED ELECTRIC FIELD FOR
LONG-TERM PRESERVATION OF FRESH FOODS**

Yoshie Kuramochi, Yasushi Minamitani
*Graduate School of Science and Engineering,
Yamagata University, 4-3-16 Jonan
Yonezawa, Yamagata 992-8510, Japan*

Currently, foods have been mainly sterilized using chemicals, heating and ultraviolet rays. However, these methods have some problems, for example, the change of the taste and constituent, the risk of the residual chemicals and low efficiency. To solve these problems, the sterilization by the pulsed electric field has been proposed. Cells can be written as equivalent circuits by capacitors and resistors. Therefore, when the pulsed electric field is applied to the cells, parts of the cell which the voltage is applied on are different at frequency components of the pulsed electric field. For example, when the low frequency electric field is applied to the cell, the voltage concentrates to the cell membrane. If the cell membrane has over 1V of the voltage, breakdown occurs in the cell membrane. Thereby a pore is made on the cell membrane. When the high frequency electric field is applied to the cell, the voltage concentrates to the cytoplasm and the nucleoplasm. In this case, the electric field affects intranuclear inclusion body directly, such as DNA.

This work focuses on specifying effective frequency for sterilization by the pulsed electric field with high intensity and high frequency. We have developed a high frequency and high voltage burst pulse generator for investigating biological effect of high intensity and high frequency electric field on microorganisms. At last study, we have investigated the survival ratio of microorganism on the frequency 22~70MHz, 100 kV/cm, and numbers of pulses 5, 10, 20.¹ In this case, survival ratios of yeast decreased at all frequency and every number of pulses. At 70 MHz of every number of pulses, survival ratios of yeast were most decreased. The survival ratio of yeast decreased to 30 % at the frequency of 70 MHz on 20 pulses. However, a survival ratio of E. coli decreased only 25 % at 70 MHz by applying 20 pulses. Therefore, in this study, we have investigated the sterilization of microorganisms at the frequency over 70 MHz and number of pulse over 20. In results, the survival ratio of E. coli linearly decreased with logarithmic increasing of the number of pulses applying to E. coli. The survival ratio of E.coli decreased to 30 % at 200 pulses with 70 MHz.

1. Y. Minamitani, Y. Kuramochi, et. al.; "Effect of frequency of burst pulse high electric field and burst pulse high intensity electromagnetic wave on microorganisms", The 17th IEEE International Pulsed Power Conference, (2009)

* A part of this research has been supported by a Grant-In-Aid of Science Research from Japan Society for the Promotion of Science