

高電界パルス処理によるホウレンソウ内ペルオキシダーゼの不活性化 Inactivation of peroxidase in spinach by pulsed electric field

佐藤広崇¹⁾, 高橋克幸^{1),2)}, 高木浩一^{1),2)}, 折笠貴寛¹⁾, 青木仁史³⁾, 鎌形潤一³⁾
H. Sato¹⁾, K. Takahashi¹⁾²⁾, K. Takaki¹⁾²⁾, T. Orikasa¹⁾, H. Aoki³⁾, J. Kamagata³⁾

岩手大学¹⁾, 次世代アグリイノベーションセンター²⁾, 株式会社ニチレイフーズ³⁾
Iwate University, Agri-Innovation Center, Iwate University, Inc Nichirei Food

1. Introduction

The control of endogenous enzymes is important for all food products in to keep freshness and safety. Currently, heat treatment has been widely used as an enzyme control technology, however useful functional components, such as aromatic components and vitamins, are lost by volatilization and decomposition during treatment^[1]. In recent years, pulsed electric fields (PEF) treatment has been attracting attention as an alternative to heat treatment for enzyme inactivation. It has been reported that enzyme dissolved in a solution can be effectively inactivated by PEF application^[2]. In this study, inactivation of enzyme contained inside a cell in fruits and vegetable by PEF application is investigated. Spinach is used as a sample, and activity of peroxidase is evaluated. The influence of pulse width on the enzyme inactivation is investigated.

2. Experiment

Spinach was purchased from a local market. Two samples, which has an area of 30 mm × 60 mm, are obtained from light and right sides in one leaf by cutting using a stainless-steel knife. into which cut into a glass vessel in which parallel plate electrode structures are put. Twelve pieces of spinach leaf sample are placed between the parallel plates with a gap of 10 mm, and pulsed voltage is applied to the electrodes.

A capacitive-energy-storage type pulse generator using SiC-MOSFETs was used as the power supply. The applied voltage (v_0) ranges from 2 to 4 kV, pulse width (W_p) ranges from 0.5 to 2 μ s, number of pulse per second (N_p) ranges from 15 to 60 pps, and processing time ranges from 1 to 60 min. Peroxidase enzyme activity was estimated by a method suggested by Ogura *et al*^[3]

3. Result

Figure 1 shows the ratio of enzyme activity of spinach for various treatment time. The enzyme activity decreases with PEF treatment. The inactivation ratio increases with increasing treatment time and reaches to 35 % with a treatment time of 30 min. Figure 2 shows the ratio of enzyme activity for spinach for various input voltage. The inactivation was about 30 % regardless of the electric field strength. The results show that Joule heating and exudation of cell fluid due to cell membrane destruction may cause the inactivation of enzyme in the spinach leaf.

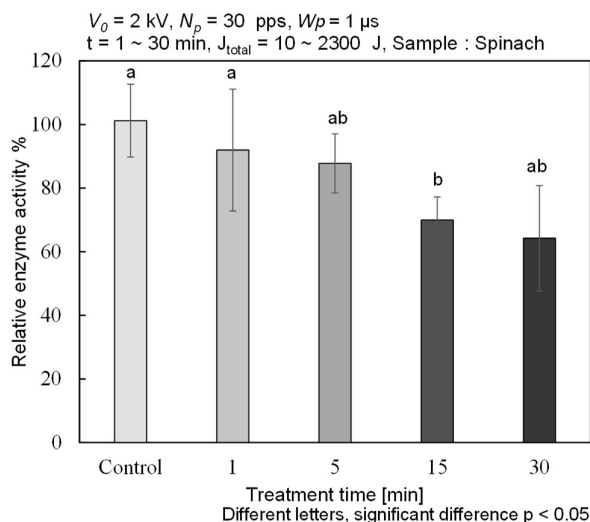


Fig.1. The ratio of enzyme activity of spinach at each treatment time

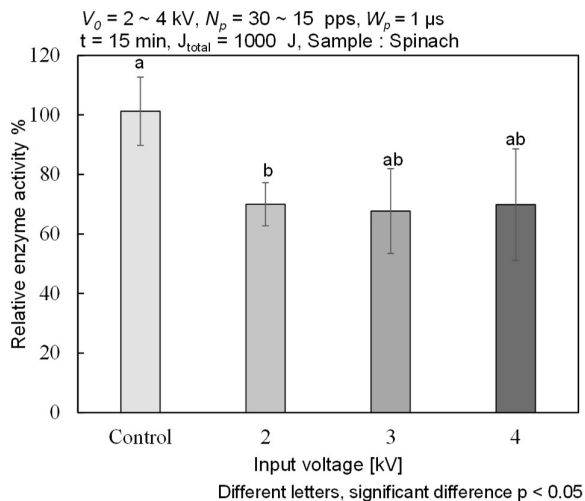


Fig.2. The ratio of enzyme activity of spinach at each input voltage

References

- [1] N.U. Haase, *et. al.* : "Ascorbic acid losses during processing of French fries and potato chips", Journal of Food Engineering, Vol.56, pp. 207-209 (2003)
- [2] K. Zhong, *et. al.* "Inactivation kinetics and secondary structural change of PEF-treated POD and PPO", Food Chemistry, Vol. 100, pp. 115-123 (2005)
- [3] N. Ogura, *et. al.* Faculty of Horticulture, Chiba University, Matsudo, Japan. Tech. Bull. Fac. Hort. Chiba Univ., No.19 : 55-62, 1971.