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The Effect of Nisin on the Storage of Sous *Vide* Processed Korean Seasoned Beef

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Introduction

Sous vide processed (cook-chilled) foods are generally processed by giving the final package a mild heat-treatment, and are stored at refrigeration temperatures to achieve adequate shelf-life. These products offer excellent quality to the consumer, and retain the typical characteristics of fresh food (1). However, though the mild heat treatment kills vegetative forms of microorganisms, it is inadequate to kill bacterial spores[2,3]. However, because of the well-known difficulties in maintaining low storage temperatures along the distribution chain, and to ensure a greater safety level, it has been proposed that other hurdles be included in the manufacture of sous vide products, such as, the incorporation of bacteriocins[4]. The Korean dish called Jangzorim has salty taste with a harmonized savory flavour and is served with cooked rice as an appetizer. The availability of a product with improved storage stability would broaden the product opportunity in terms of its routine consumption. In the present study, sous vide packaging technology was investigated as a means of achieving these aims. Thus this study was undertaken to evaluate the physical and chemical qualities and microbiological safety of sous vide processed seasoned beef, and in particular, to evaluate the effect of nisin on its storage stability.

Material and Methods

Strains Bacillus cereus ATCC 11778 and *Clostridium perfringens* ATCC 3624 were used in this study. To induce spore forming, cultures were heat-shocked at 80℃ for 2 min prior to use, and diluted to 6 log cfu/mL.

Nisin A standard stock solution of nisin containing 1×10^6 IU/mL was prepared by dissolving 100 mg of nisin in 0.02 M HCl (1 mL) and adding 9 mL of distilled water.

Sous vide processing and packaging of Korean seasoned beef

A coextruded multilayered film, C5045 was used for packaging. Pouches were heat-sealed under vacuum and then pasteurized for 11 min in the boiling water. Sous vide processed packages were then stored at 4℃ and 25℃ for 60 days.

Physical and chemical analysis

The texture of the meat blocks during heating procedure was measured using a Rheometer. The surface color of the meat was measured using a Hunter color system using a Color Difference. The pH of the product was measured for the brine solution using an Orion model 520A pH Meter. The salinity of the product was measured using an Orion model 920A pH Meter with a Cl- ion selective electrode.

Microbiological analysis

Mesophilic microorganisms were determined using Plate Count Agar (PCA) at 35℃ for 48 hr. Psychrotrophic microorganisms were incubated at 21℃ for 72 hr using PCA, and anaerobic microor-ganisms were counted by spread-plating on PCA using a BBL anaerobic jar (Difco). All plates were incubated anaerobically at 35℃ for 48 hr. *B. cereus* numbers were determined using Cereus Selective Agar (Merck, Darmstadt, Germany) at 30℃ for 24 hr, and *C. perfringens* numbers were determined using STP agar (Oxoid, Basingstoke, UK) using a BBL anaerobic jar (Difco) at 35℃ for 24 hr.

Results and Discussion

Physicochemical analysis Changes in physicochemical during storage of sous vide processed seasoned beef are shown in Fig. 1. The textures of control samples, and of samples inoculated with *B. cereus* ATCC 11778 and *C. perfringens* ATCC 3624 at 25℃ storage reduced markedly, but samples containing nisin stored at 25℃ and 4℃ showed no significant changes during the storage periods. No major changes

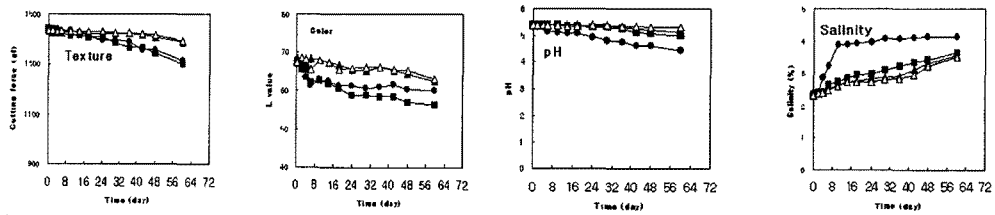

Fig. 1. Changes of physicochemical in the absence or presence of nisin in sous vide processed beef products during storage at 25℃. Control samples (●), Samples inoculated with *Bacillus cereus and Clostridium perfringens* (■), Samples inoculated with *Bacillus cereus, Clostridium perfringens*, and nisin 100 IU (▲), Samples inoculated with *Bacillus cereus*, *Clostridium perfringens*, and nisin 500 IU (△).

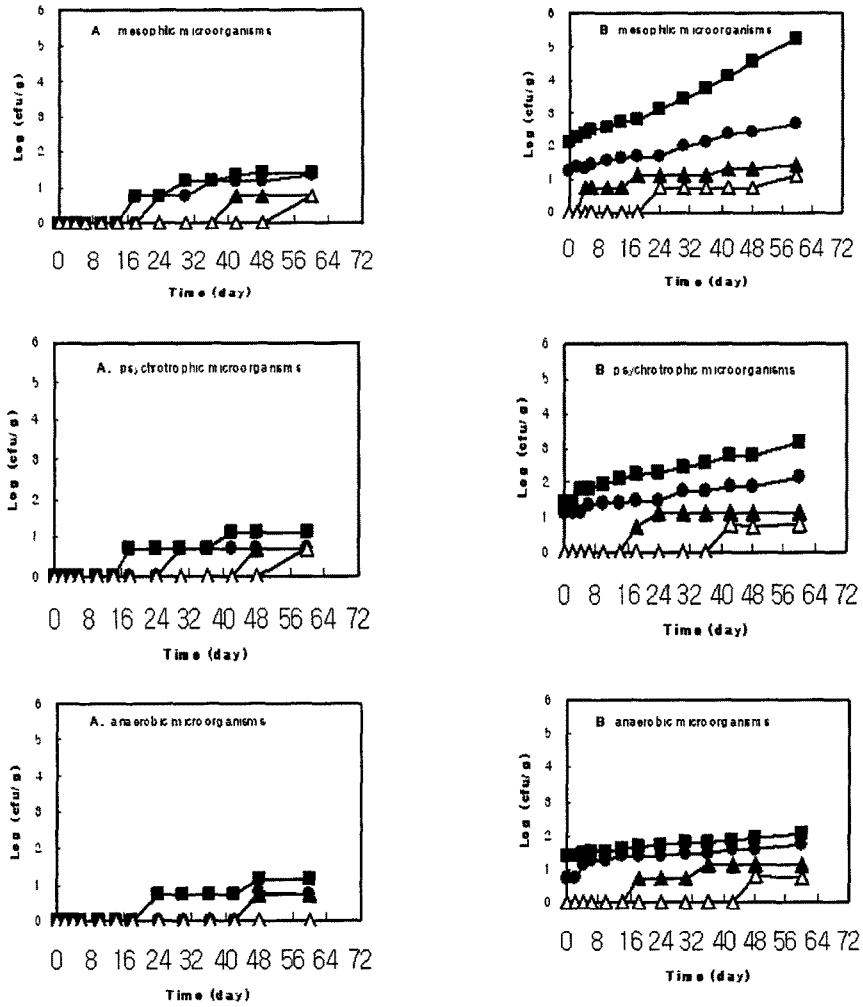

Fig. 2. The behavior of microorganisms in the absence or presence of nisin in sous vide processed beef products during storage at 4℃ and 25℃. Control samples (●), Samples inoculated with *Bacillus cereus* and *Clostridium perfringens* (■), Samples inoculated with *Bacillus cereus*, *Clostridium perfringens*, and nisin 100 IU (▲), Samples inoculated with *Bacillus cereus*, *Clostridium perfringens*, and nisin 500 IU (△).

in the color of sous vide cooked seasoned beef were observed with respect to the presence of nisin or storage temperature conditions. Control sample pHs slowly decreased at 4℃ and 25℃, the samples showed no changes during 4℃ and 25℃ storage. The salinity of control samples in storage at 25℃ increased markedly, all other samples showed gradual increase.

Microbiological analysis

Changes in the numbers of microorganisms during storage of *sous vide* processed seasoned beef are shown in Fig. 2. The numbers of mesophilic microorganisms in samples inoculated with *B. cereus* and *C. perfringens* markedly increased at 25℃ storage. But growths of mesophilic microorganisms were inhibited by nisin to the level of the control at 4℃. No major changes in control samples or in samples with nisin were observed during storage period at 4℃ The number of psychrotrophic microorganisms in control samples and in samples inoculated with B. cereus and *C. perfringens* increased at a storage temperature of 25℃, while samples with nisin showed no significantly changes during storage. Anaerobic microorganism numbers showed the same trend as psychrotrophic microorganisms.

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