Change in Characteristics of Chinese-style Sausage Caused by Starter Culture.

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Introduction

In several studies on microbial ecology and biochemical characteristics in Chinese style-sausage, the total plate count of products were 10^6~10^8 CFU /g and the major microbial strains were coagulase negative staphylococci staphylococci (28.4 %) and micrococci (46.3 %) that belonged to micrococcaceae(Guo and Chen, 1991;Chen and Guo, 1992;Chen *et al.*, 1997).

Many sausages inoculated with starter culture to improve quality. The most popular micrococcaceae cultures are *M. varians, S. carnosus* and *S. xylosus* (Hammes and knauf ,1994). They have catalase to destroy peroxide and reduce nitrate to nitrite (Neubauer and Gotz,1996).Chinese style-sausage , a neutral flora and non-fermented product , was populared in Taiwan. It is interesting topic to study the functional role of micrococcaceae in Chinese-style sausage. The Chinese-style sausage was prepared by a traditional method with micrococcaceae and the pH, water activity, microbial counts , color, nitrite concentrations and peroxide value (POV) were determined during storage.

Materials and Methods

Sausage preparation: All sausages were made of 80 % ground lean pork ham(1/2 inches plate) and 20 % lard. Except the control, three different treatments were performed with 10^6 CFU /g of *M. varians, S. carnosus* or *S. xylosus* , individually. Sodium chloride (2 %), monosodium glutamate (0.5 %), sugar (2 %), rice wine (5 %) and pepper(0.1 %), were mixed with 100 ppm $NaNO_2$ and 150ppm $NaNO_3$. All ingredients were added to raw material, then mixing, curing(6 ℃, 24 hours) and drying at 52 ℃ for 6 hours .

Sampling: Sausages were prepared and treated by hang or vacuum package and stored at 20 ℃ for 7 days or 21 days. The growth of microorganisms, pH value, water activity (Aw), POV, nitrites residue and L* a* b* value were measured.

pH and water activity: The pH of samples was measured by SUNTEX pH meter(TS-1). Water activity was determined by water activity measurement (CX-2,Decagon, U.S. A.).

Nitrites and POV: Nitrite residue was determined by Ockerman's(1974) methods. Peroxides were extracted by chloroform/methanol and colored by xylene orange .

Microbial analysis: Microbial growth evaluation of samples performed with plate count agar (37 ℃, 2 day), mannitol salt agar(30 ℃, 3 day) and MRS agar (37 ℃, 3 day,).

Color determination: color of samples (CIE L*a*b*)were observed by handy colorimeter(Nippon Denshoku, NR-300).

Results and Discussion

During 14 day storage, the pH value of samples remained constant among 5.78 and 5.93 (Fig.1a.). A 0.3~0.4units of pH decreased from the 14th to 21st day storage. The Aw of the samples with vacuum package or hang unchanged during storage.

The POV increased rapidly during 24 hr. curing (Fig. 2a) and rose from 0.244~0.285 to 0.362~0.373 after drying. Sausages with hang remained stable (0.362 to 0.373) but the sample with vacuum package declined at the 7th day storage. POV value of the products reached a minimum value (0.259~0.285) after 3 weeks. However, the samples with starter were lower than the control at the 21st day storage.

Nitrites residue of all samples decreased after 24 hours curing(Fig. 2b). A reducing condition (nitrate → nitrite)was found in the samples treated by 3 different starters with hanging or vacuum package, individually. A nitrite residue level of the sample with *S. xylosus* with vacuum package still maintained during storage and this result indicated S. xylosus was a adequate strain in the product with vacuum package.

The microorganism counts of all sausages increased with storage time increasing and the growth of microorganisms of samples with hang were faster than the samples with vacuum package during storage (Fig. 3. a, b, c). Sausages with starter had higher total aerobic count, lactic bacteria count and micrococceae count than the control. It was noted that micrococcaceae still below 10^6 CFU/g for 24 hours curing in all sausages with starters. These microorganisms of the samples with starters and vacuum package growed slowly from 10^6 to 10^7 CFU/g during 3 weeks storage. It was possible that a fermentation with low temperature (6 ℃) and short time (24 hours) resulted in decreasing the growth rate of microorganisms.

The results of L* a* b* value of the samples were shown in Fig.4a, b, and c. Regardless of L value of sausages with vacuum package increasing or that of sausages with hang decreasing, color of all sausages were stable during the first week storage.

Reference
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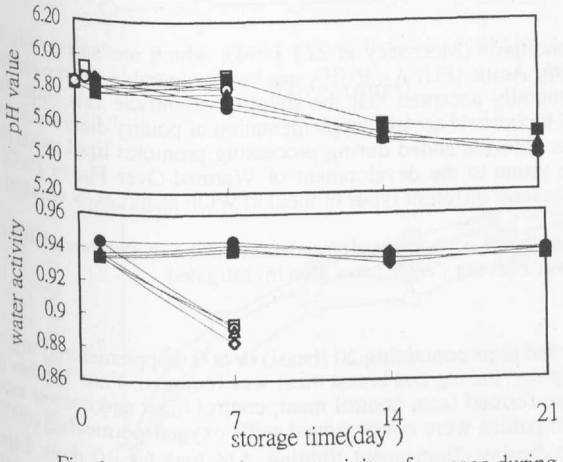

Fig. 1. pH value and water activity of sausage during storage.

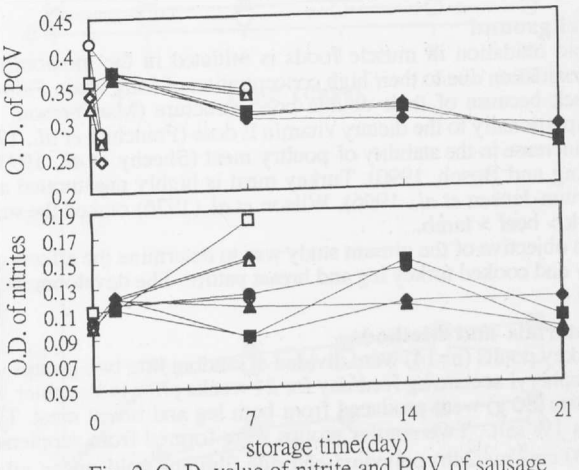

Fig. 2. O. D. value of nitrite and POV of sausage inoculated with different Micrococcaceae.

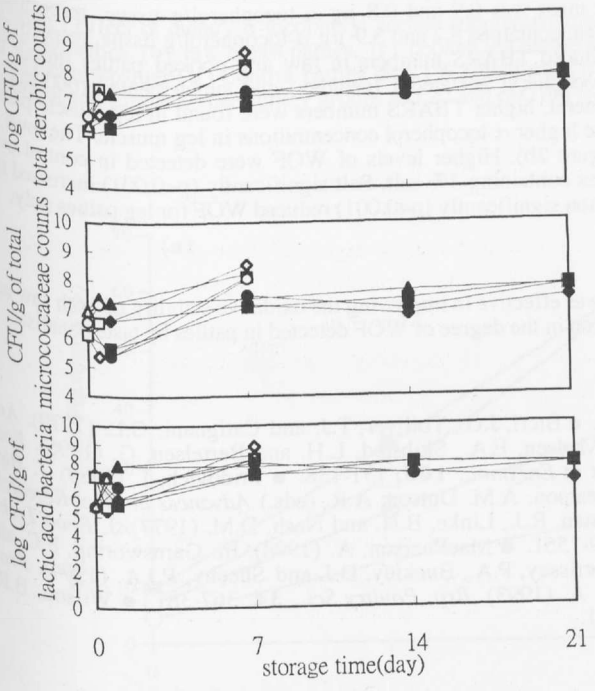

Fig. 3 Changes of bacterial counts during storage storage.

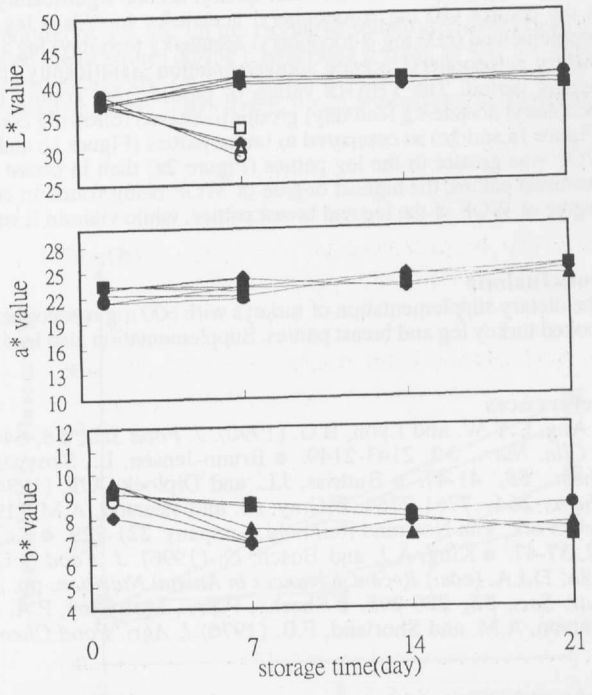

Fig. 4. Changes of L* a* and b* value of sausage during storage.