

Isolation and Identification of Microbial Strains from Swollen Package of Meat Products and Spices in Taiwan

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Keywords: spices, swollen package, heterofermentative

Introduction

The swollen package of meat products is one of meat industry problems in Taiwan. This phenomenon resulted in refund and economic loss. The off-flavor can be induced by the defects of package due to microbial growth. To know which microorganism can induce this problem is necessary. Therefore, the purpose of this study was to investigate the contamination level of spices used in meat products currently in Taiwan and also to look for which microbial strain is the main strain in swollen package. On the other hand, The optimum of sterilization of spices was also set up in this test.

Materials and Methods

The spice samples obtained from different companies were used for testing. These spices were divided into two treatments. one was sterilized by radiation at China Biotech Corporation(γ -rad, 27-30 kGy, 40hr) under room temperature and another was sterilized by autoclaving (121⁰C, 1.5kg/cm², 15 min). Total plate count, yeast and mold count, aerobic thermophile count, coliform, *Lactobacillus*, aerobic thermophilic flat-sour type, and *Bacillus* of spice samples before and after treatment were determined by FDA's methods (1976). The swollen packages of meat samples were obtained from market. The microbiological quality which included total plate count, yeast and mold count, aerobic thermophile, coliform, *Lactobacillus*, anaerobic bacteria, and *Bacillus* of the swollen samples also were analyzed by FDA's procedure. All data were analyzed by SAS system (1994).

Results and Discussion

Black pepper had the highest total plate count, yeast and mold count, aerobic thermophile count and coliform among all spice samples. The logarithmic number of microorganisms of white pepper was from 1 to 5. The logarithmic number of total plate count of Chinese blended spice powder and garlic were larger than 3, and the red pepper was above 4.6.(Table 1 to 3). Cinnamon had a high amount of cinnamic aldehyde which was a strong antibacterial and resulted in less contamination (Table 2). The aerobic themophiles count of most of the spices were high because them imported from tropics or subtropical area(Table 3). The results indicated that the contamination level of spice samples depended upon different sources and brands. The spice under radiation and sterilization showed no microbial growth. The agglutination and off-flavor of spice were found on onion powder and white pepper sample after radiation. It was found that seventy percent of isolated microorganisms in all swollen package samples was *Lactobacillus*. And 30% of *Lactobacillus* isolated from the swollen package samples was heterofermentative (Table 4). The result of isolation and identification of heterofermentative *Lactobacillus* was showed in table 5.

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Table 1. The total plate counts of different spices.

	Total plate count						log(CFU/g)	Radiation	Autoclave
	A	B	C	D	E	F			
Black pepper	7.14 ^b	3.60 ^a	8.03 ^a	6.91 ^c	4.06 ^d	7.01 ^{bc}	ND	ND	
White pepper	4.29 ^b	<1 ^f	3.12 ^a	3.82 ^d	4.04 ^c	5.01 ^a	ND	ND	
Chinese blended spice powder	4.09 ^d	3.88 ^a	3.01 ^f	5.11 ^a	4.26 ^c	4.88 ^b	ND	ND	
Licorice powder	<1.3	2.62	-	-	-	-	ND	ND	
Garlic	4.94 ^a	3.85 ^b	-	-	-	-	ND	ND	
Red pepper	6.96	-	-	-	-	-	ND	ND	
Cinnamon	-	-	2.65 ^b	<1 ^c	4.02 ^a	-	ND	ND	

n=9

- : means sample absent.

ND : No count is observed.

A,B,C,D,E,F : means different spice source.

Radiation : 27-30 kGy dose is used in this experiment.

Autoclave : all the sample are autoclaved for 15 mins, at 121°C, 1.5 kg/cm².

a,b,c,d,e,f : means within the same row without the same superscript letters are significantly different (P<0.05).

Table 2. The yeast, mold, acid-tolerant bacteria of different spices.

	Yeast, mold, acid-tolerant bacteria						log(CFU)	Radiation	Autoclave
	A	B	C	D	E	F			
Black pepper	6.93 ^a	<1 ^c	ND ^c	6.88 ^a	<1 ^b	<1 ^b	ND	ND	
White pepper	4.12 ^b	<1 ^d	2.87 ^c	2.94 ^c	2.74 ^b	2.72 ^a	ND	ND	
Chinese blended spice powder	4.02 ^b	3.02 ^c	2.84 ^{cd}	4.97 ^a	2.61 ^d	<1.5 ^e	ND	ND	
Licorice powder	<1	<1	-	-	-	-	ND	ND	
Garlic	3.83 ^b	4.08 ^a	-	-	-	-	ND	ND	
Red pepper	5.35	-	-	-	-	-	ND	ND	
Cinnamon	-	-	<1	<1	2.92	<1	ND	ND	

n=9

- : means sample absent.

ND : No count is observed.

A,B,C,D,E,F : means different spice source.

Radiation : 27-30 kGy dose is used in this experiment.

Autoclave : all the sample are autoclaved for 15 mins, at 121°C, 1.5 kg/cm².

a,b,c,d,e : means within the same row without the same superscript letters are significantly different (P<0.05).

Table 3. The aerobic thermophile of different spices.

	Aerobic thermophile log(CFU/g)						Radiation	Autoclave
	A	B	C	D	E	F		
Black pepper	6.80 ^b	2.67 ^e	7.69 ^a	6.16 ^c	3.93 ^d	6.74 ^b	ND	ND
White pepper	4.12 ^b	<1 ^e	3.00 ^c	2.59 ^d	2.86 ^{cd}	4.35 ^a	ND	ND
Chinese blended spice powder	3.09 ^b	3.03 ^b	2.76 ^c	4.00 ^a	4.10 ^a	4.10 ^a	ND	ND
Licorice podwer	<1	<1	-	-	-	-	ND	ND
Garlic	3.97	<1.3	-	-	-	-	ND	ND
Red pepper	6.16	-	-	-	-	-	ND	ND
Cinnamon	-	-	<1 ^c	<1 ^c	2.95 ^b	4.14 ^a	ND	ND

n=9

— : means sample absent.

ND : No count is observed.

A,B,C,D,E,F : means different spice source.

Radiation : 27-30 kGy dose is used in this experiment.

Autoclave : all the sample are autoclaved for 15 mins, at 121°C, 1.5 kg/cm².

a,b,c,d,e : means within the same row without the same superscript letters are significantly different (P<0.05).

Table 4. The number of heterofermentative strains isolated from swelling sample.

swollen sample	kinds	isolated of strains
A	sausage	17/60
B	sausage	17/78
C	ham	13/47

A, B, C means different samples

A 5 + + *Streptococci* - - - +

Table 5. The primary identification of isolated strains.

strains	heterofermentative	Gram stain	shape	mobility	spore forming	catalase activity test	anaerobic cultivation
A 5	+	+	<i>Streptococci</i>	-	-	-	+
7	+	+	<i>Micrococci</i>	-	-	+	+
5	+	+	rods	-	-	-	+
B 8	+	+	<i>Streptococci</i>	-	-	-	+
9	+	+	rods	-	-	-	+
C 5	+	+	<i>Streptococci</i>	-	-	-	+
8	+	+	rods	-	-	-	+

A, B, C means different samples