EFFECTS OF PREBLENDING OF SALT, PHOSPHATE, AND BICARBONATE SOLUTIONS ON PORK SAUSAGE

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Abstract – Effects of preblending of liquid solutions (salt, phosphate, and bicarbonate) on pork sausage were investigated. Pork loins were obtained from one side of 5 pigs after slaughter, ground through a 7-mm, divided into 8 groups and preblending to 110% of their initial weight with water. Non preblending of control (C1), 5% NPS (C2), 5% salt (T1), 5% phosphate (T2), 3% bicarbonate (T3), 5% salt and 5% phosphate (T4), 5% salt and 3% bicarbonate (T5), 5% phosphate and 3% bicarbonate (T6). All treatment samples had a significantly higher pH values and emission stability than the C1 (p<0.05). Also, cohesiveness, springiness and gumminess value were significantly increased with treatment of preblending solutions (T5 and T6) (p<0.05). Sensory evaluation showed that the flavor was also significantly increased by treatment with preblending solutions (T5) (p<0.05). Furthermore, texture and overall acceptability scores were improved by preblending 5% salt and 5% phosphate (T4). In conclusion, measurements such as emulsion stability, texture properties and sensory attributes of cooked pork sausage could be improved using a preblending solution of salt, phosphate, and bicarbonate.

Key Words – Pork, Preblending, Salt, Phosphate, Bicarbonate

I. INTRODUCTION

Preblending consists of the grinding and mixing of mixing of separate meat ingredients with part or all of the cure (salt and nitrite and/or nitrate) in proportion to the amount of meat. Preblending has the advantages: the final blend to a known fat content, helps to control meat spoilage, the improve emulsification and retards oxidation of the raw materials.

Salt and phosphate are commonly used, sometimes alone but often in combination to exploit their synergistic action [1]. Salt use not only improves juiciness and tenderness but also increases the weight of saleable product, due to the retention of added water [2]. Concentrations must be sufficient to improve tenderness and juiciness but without adversely affecting flavor and color, or causing over-tenderization [2]. Phosphate was originally developed to help lower the sodium content of processed meats, such as ham, but has been incorporated into fresh meats to improve tenderness and juiciness [3]. Bicarbonate reduced drip loss and reduced shear force [4], presumably because of improved water holding at elevated pH [5]. Also, all materials can be blending by the conventional liquid-blending procedure.

Therefore, the purpose of the present work was to quantify the preblending effects of salt, phosphate and bicarbonate solutions on pH, texture and, thus, assess the potential of pork sausage. Ingredients were used singly and in combination to exploit potential synergistic or complementary effects.

II. MATERIALS AND METHODS

1. *Sample preparation*

The pork loins were dissected from carcass 48 h postmortem and trimmed to remove visible fat before grinding through 7-mm plate. Preblending to a target of 110% of original weight with one of the following eight solutions (g/100g water): Non preblending (C1), 5% NPS (salt : sodium nitrite = 99.4 : 0.6) (C2), 5% salt (T1), 5% sodium phosphate (T2), 3% sodium bicarbonate (T3), 5% salt and 5% sodium phosphate (T4), 5% salt and 3% sodium bicarbonate (T5), 5% sodium phosphate and 3% sodium bicarbonate (T6). Following preblending, the loin samples were covered with plastic film and held at 4°C for 24 h to allow for equilibration. For each batch of sausages, all ingredients were adjusted to final compositions of 67% loin, 20% fat, 10% water, 1.45% salt, 1.2% sugar and 0.35% phosphate and homogenized in a silent cutter (AS-30, Ramon, Spain). The emulsified meat batters were stuffed

into polyvinylidene chloride casings (50 mm diameter) and cooked for 30 min at 75°C in the steam chamber (SAA10, Absury, Berlin, Germany), storage at 4°C.

2. Analytical methods

The pH value of the sample was determined using a pH meter (MP230, Mettler Toledo, Switzerland). Moisture content (%) was analysed by AOAC (1995) [6]. Emulsion stability was measured following the procedure of Hughes et al. [7]. Surface color (CIE L*, a*, b) was analysed by using of chroma-meter (CR-300, Minolta, Japan). Textural properties were analysed by using of Rheo-meter (Compac-100, Sun scientific Co., Japan). Sensory evaluation were recruited and trained by eight panelists.

The statistical analysis was performed by SAS program [8]. The data were subjected to analysis of variance (ANOVA) and Duncan's test to compare the sample means.

III. RESULTS AND DISCUSSION

The changes in pH, moisture content, emulsion stability, meat color and texture of pork sausage were presented in Table 1. The pH values of pork sausage range from 6.09 - 6.35. The pH value of T6 (5% sodium phosphate and 3% sodium bicarbonate) was significantly higher than those of other samples ($p<0.05$). The moisture content varied from 58.42 - 60.00%. The C1 (Non preblending) showed a significantly lower emulsion stability than those of the other treatments ($p<0.05$). Also, the emulsion stability value of T5 (5% salt and 3% bicarbonate) was significantly higher than those of other samples ($p<0.05$). The lightness (CIE L*) value was significantly higher of T4 (5% salt and 5% sodium phosphate) than all treatments ($p<0.05$). The redness (CIE a*) value was significantly higher of C2 (5% NPS) than all treatments ($p<0.05$). The preblending of 5% NPS solutions changed the color attributes of the pork sausage by increasing redness. The hardness values of pork sausage range from 0.30 - 0.35kg. The cohesiveness, springiness and gumminess value were significantly higher of C2 (5% NPS) than C1 (Non preblending) ($p<0.05$). Especially, the hardness value of T6 (5% sodium phosphate and 3% sodium bicarbonate) was significantly higher than those of other samples ($p<0.05$). Also, the cohesiveness, springiness and gumminess value were significantly higher of T6 (5% sodium phosphate and 3% sodium bicarbonate) than C1 (Non preblending) ($p<0.05$). The color values of pork sausage range from 2.50 - 5.50 (Fig.1). The color scores of C1 (Non preblending) was lower than those of other samples ($p<0.05$). Sensory results indicated that the flavor was significantly higher in the T5 (5% salt and 3% bicarbonate) than the sausage treatment groups ($p<0.05$). Further, texture and overall acceptability scores were improved by preblending 5% salt and 5% sodium phosphate ($p<0.05$).

Table 1. pH, moisture (%), emulsion stability (%), color and texture of pork sausage

	Treatments[1)]							
	C1	C2	T1	T2	T3	T4	T5	T6
Physicochemical analysis								
pH	6.12±0.01^{F}	6.09±0.00^{G}	6.21±0.01^{E}	6.24±0.01^{D}	6.26±0.01^{C}	6.33±0.02^{B}	6.32±0.02^{B}	6.35±0.01^{A}
Moisture	60.00±0.18^{A}	59.73±0.14^{BC}	59.89±0.09^{AB}	59.64±0.10^{C}	59.52±0.12^{C}	58.42±0.08^{E}	59.26±0.08^{D}	59.60±0.20^{C}
Emulsion Stability	84.86±0.59^{E}	92.41±0.16^{BC}	91.54±0.47^{C}	93.32±0.13^{B}	93.02±0.31^{B}	90.04±0.74^{D}	95.02±1.30^{A}	91.42±0.56^{C}
CIE L*	80.23±0.24^{E}	80.68±0.28^{D}	80.46±0.39^{DE}	81.76±0.16^{B}	81.63±0.25^{B}	82.35±0.16^{A}	80.52±0.17^{DE}	81.27±0.22^{C}
CIE a*	0.58±0.05^{F}	1.80±0.06^{A}	0.98±0.09^{E}	1.54±0.03^{C}	1.11±0.03^{D}	1.02±0.04^{E}	1.56±0.03^{C}	1.67±0.06^{B}
CIE b*	11.52±0.07^{A}	10.77±0.14^{D}	11.61±0.19^{A}	11.21±0.10^{B}	10.99±0.11^{C}	10.99±0.11^{C}	11.59±0.16^{A}	10.23±0.22^{E}
Hardness	0.31±0.02^{BC}	0.33±0.02^{BC}	0.30±0.02^{C}	0.32±0.03^{BC}	0.33±0.01^{AB}	0.32±0.05^{BC}	0.32±0.02^{BC}	0.35±0.01^{A}
Cohesiveness	0.51±0.02^{C}	2.20±0.17^{A}	0.50±0.05^{C}	0.54±0.09^{C}	0.48±0.05^{C}	0.52±0.05^{C}	1.69±0.17^{B}	1.76±0.08^{B}
Springness	1.04±0.03^{D}	3.57±0.14^{A}	1.05±0.09^{D}	1.13±0.14^{D}	1.08±0.07^{D}	1.07±0.11^{D}	2.99±0.19^{C}	3.24±0.08^{B}
Gumminess	0.16±0.02^{D}	0.70±0.04^{A}	0.15±0.02^{D}	0.17±0.03^{D}	0.16±0.02^{D}	0.16±0.01^{D}	0.53±0.03^{C}	0.62±0.04^{B}

Data are means ± standard deviation. n=3.

[1)] C1: Non preblending; C2: NPS (salt : sodium nitrite = 99.4 : 0.6); T1: 5% salt; T2: 5% sodium phosphate; T3: 3% sodium bicarbonate; T4: 5% salt and 5% sodium phosphate; T5: 5% salt and 3% sodium bicarbonate; T6: 5% sodium phosphate and 3% sodium bicarbonate.

[A-H] Means within a row with different superscript letters are significantly different at $p<0.05$.

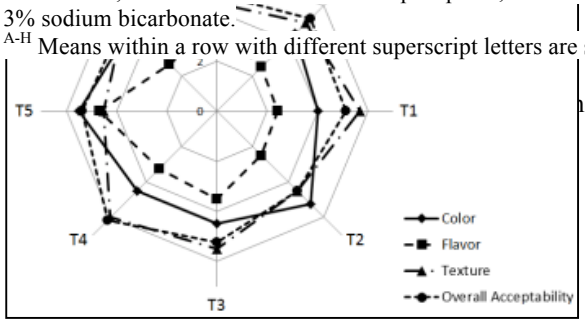

Fig. 1. Change in sensory evaluation of pork sausage. C1:

Non preblending; C2: NPS (salt : sodium nitrite = 99.4 : 0.6); T1: 5% salt; T2: 5% sodium phosphate; T3: 3% sodium bicarbonate; T4: 5% salt and 5% sodium phosphate; T5: 5% salt and 3% sodium bicarbonate; T6: 5% sodium phosphate and 3% sodium bicarbonate. *Sensory evaluation: Based on a 9-point intensity scale (1=dislike extremely or extremely light/bland/tough; and 9=like extremely or extremely dark/intense/tender).

IV. CONCLUSION

In conclusion, we found that preblending of salt, phosphate, and bicarbonate solutions on pork sausage samples improved emulsion stability, tenderness, texture and overall activity compared to C1 (Non preblending). Therefore, we suggest that pork sausage can be used singly or combination from the preblending of salt, phosphate and bicarbonate solutions, which had better textural properties.

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