THE FORMATION OF CRUST AND ITS RELATIONSHIP TO WATER MIGRATION OF LAMB DURING AIR DRYING

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Abstract –The aim of this study was to investigate the relationship of the crust and moisture migration of lamb during air drying at 35ºC, 60% relative humidity and wind speed of 3 m/s. The results showed that the thickness of crust increased on the surface of lamb during air drying, but the crust were disappeared after 48 h storage. It indicated that the formation of crust might be due to the moisture of the surface decreased (*P* < 0.05) more quickly than the interior of lamb during air drying. Microstructure results revealed that the decrease of crust porosity might be due to the shrinkage of connective tissue. It was concluded that crust was a critical factor for water migration in lamb during air drying.

Key Words – water migration, dried lamb, porosity, crust

I. INTRODUCTION

Energy is a major cost in the processing of dried meat. Shortening drying time or improving energy efficiency would result in increase in profit and decrease in carbon dioxide emissions[1]. Studying the mechanism of moisture migration during air drying under low temperature is crucial to control the process. The crust will be formed on the surface of the meat during air drying. However, studies on crust formation and its relationship to moisture migration of air dried meat are very limited. Therefore, this study was carried out to investigate the curst formation and its effect on water migration of meat during air drying.

II. MATERIALS AND METHODS

Muscle topside sampled from feedlot sheep with 8 months old, which were cut into cubes (1.5×1.5×3 cm) and hung in a dryer and air dried at 35ºC, 60% relative humidity, 3 m/s wind speed. The samples were taken out randomly when the moisture content decreased to 70%, 65%, 60%, 55%, 50%, 45%. Pictures of the cross section of dried lamb were taken and the thickness of the brown-colored crust was measured using Image-Pro Plus 6.0. A light microscope was used to examine the microstructure of the dried lamb. Texture analyzer equipped with a Warner–Bratzler shear head was used to detect the shear force. The dried lamb cubes with 45% moisture were stored at 4℃ for 48 h, and the shear force was measured. Differences between treatments were evaluated by one-way analysis of variance (ANOVA) followed by multiple comparison Turkey test. All data were presented as means ± standard deviation.

III. RESULTS AND DISCUSSION

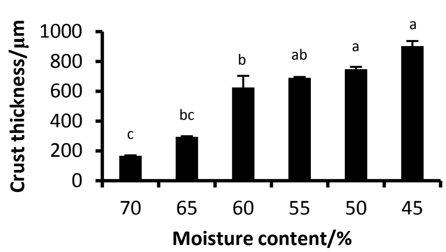


Figure 1 Thickness of colored crust of lamb during air drying
The different lowercase letters on the bars mean significantly different (*P* < 0.05).

Thickness of colored crust increased gradually on the surface of the lamb (Figure 1). At the same time, water has heterogeneous distribution in lamb cubes when the moisture content of the whole lamb cubes decreased from 70% to 45% during air drying (Figure 2). The shear force increased with water migration, and the values changed significantly when water content decreased to 65% and 50% (P <0.05) (Figure 3).

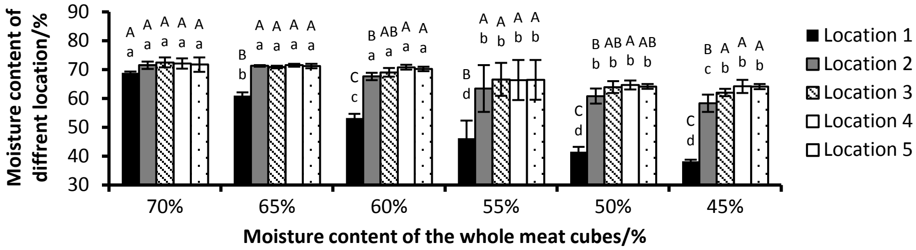


Figure 2 Change of moisture content of every location of lamb during air drying
The different lowercase letters on the bars mean significantly different for all samples ($P < 0.05$). The different capital letters on the bars mean significantly for different locations of the same water content sample ($P < 0.05$).

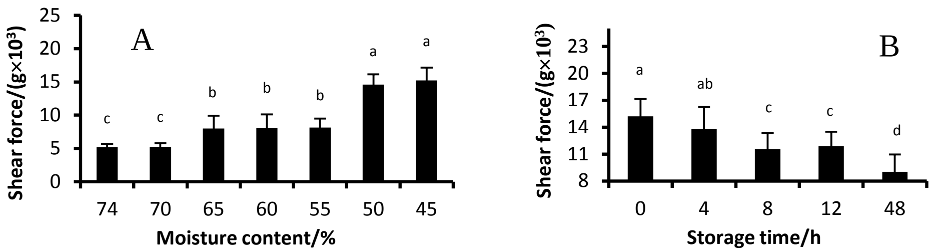
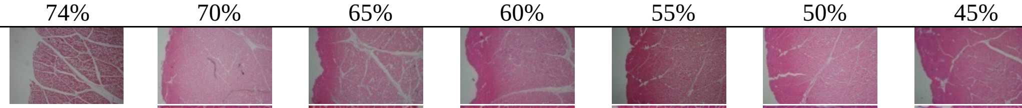


Figure 3 Shear force of lamb during air drying (A) or 4ºC storage (B)
The different lowercase letters on the bars mean significantly different ($P < 0.05$).

During the storage at 4ºC (Figure 3), the shear force was decreased gradually and the crust was disappeared, which might be due to the moisture diffused from the inner to the surface of the lamb. As shown in Table 1, the crust was more density than the central part of the lamb. The muscle fiber and the gap were both decreased during air drying.

Table 1 Light microscope images of lamb with different water content during air drying

	74%	70%	65%	60%	55%	50%	45%
Whole（4 ×）							
Crust（40 ×）							
Centre（40 ×）							

The first line was most part of the transection of lamb from the surface to internal, the second line was the crust, the third line was the center of the lamb. 4× and 40 × mean the magnification times were 4 and 40.

IV. CONCLUSION

Crust formation of lamb was due to the moisture migration of the surface ($P < 0.05$) more quickly than the interior during air drying. Shrinkage of connective tissue might cause the decrease of gap between muscle fibers, resulting in the porosity decreased and the water migration slowed down in lamb during air drying.

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