STUDY ON METMYOGLOBIN REDUCTASE ACTIVITY WITH THE CHANGE OF MEAT COLOUR DURING COOLING STORAGE

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Introduction

Meat colour depends on the amount and the state of myoglobin (Mb) in meat, containing 3 types. The red is $MbFe^{2+}$, the bright red is oxymyoglobin ($MbFe^{2+}O_2$), while the brown is metmyoglobin ($MetMbFe^{3+}$) for meat colour (Dean and Ball,1960; Ledward, 1992). The major factor leading to meat discoloration is iron autoxidation from Fe^{2+} to Fe^{3+}form. Since 1990s, it has been found there is a system of the MetMb enzymatic reduction with the colour stability in meat (Echevarne, Renerre, & Labas, 1990; Lanari & Cassens,1991; Reddy & Carpenter, 1991). Some research suggested the activity of the MetMb reductase was a controlling factor. It might retard discoloration and regulate the colour stability of meat (Cheah & Ledward, 1997; Zhu & Brewer, 1998).

In this research, the objective was to study the activity of MetMb reductase with the change of meat colour in cooling storage.

Materials and Methods

M. longissimus dorsi(LD), these meat samples were collected from pig's carcass after slaughter immediately and cooled under the dark condition at 5-10℃ for test. The test time was designed in 1st, 3rd, 5th,7th, 9th day during the storage, respectively (LD n = 10 × 3 × 5d = 150). Meat colour was measured a*, b* and L* value with SC-1 Colour-photography. At the same time, the activity of metmyoglobin reductase was also assayed with Spectrumlab54 UL-spectrophotometer at 525nm, 545nm, 565nm and 572nm, 25℃ according to the expending amount of porcine metmyoglobin (made in our Lab; MetMb(%) = (-2.541R1 + 0.777R2 + 0.800R3 + 1.098) × 100; R1, R2, R3 were A_{572}/A_{525}, A_{565}/A_{525} and A_{545}/A_{525} respectively). Horse heart metmyoglobin was the standard, purchased from Sigma Com (purity > 95%). A unit of metmyoglobin reductase in g meat was 1U = 1nmol MetMb reduced/min (n mol $min^{-1}g^{-1}$ meat).

Results and discussion

MetMb reductase in DL was decreasing rapidly from the first day to the fifth day, and then tended to smoothly low with a* value decreasing during chilled storage (Figure1-2).

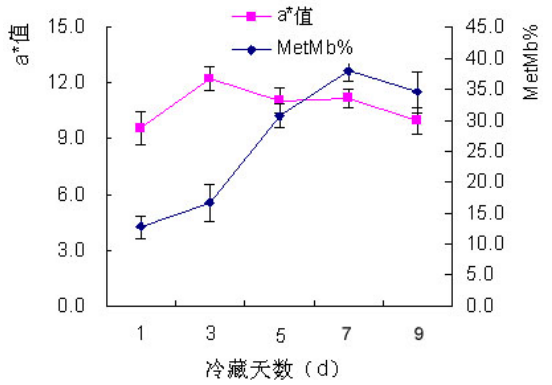

Figure 1 Changes of a* value with MetMb% during chilled storage

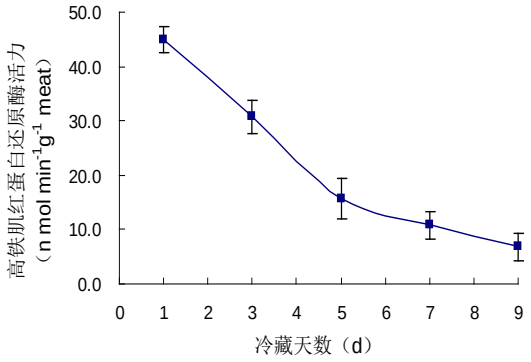

Figure 2 Changes of metmyoglobin reductase activity during chilled storage

*Correlation coefficients between color parameters and MetMb reductase.*During the chilled storage, there was significantly negative correlation between metmyoglobin reductase activity and the L* value of LD meat color ($P<0.05$*) on the 3rd day, while positive correlation between metmyoglobin reductase activity and a* value in the 3rd, 5th and 7th day during storage ($P<0.05$*; Table 1). It was found that LD meat discoloration or brown was occurred at the beginning of storage maybe with Mb autoxidation and MetMb reductase expending as soon as possible. If we wanted to inhibit the meat brown, we should control the storage conditions of meat such as light, oxygen and temperature for inhibiting the degradation of metmyoglobin reductase in the cooling meat.

Table 1 Correlation coefficients of meat colour with MetMb reductase in LD

Value	Storage Time (d)				
	1	3	5	7	9
L*	-0.09	-0.56*	-0.08	-0.05	-0.17
a*	-0.12	0.38*	0.46*	0.37*	0.13
b*	0.17	-0.41	-0.19	-0.24	-0.25

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Conclusions

The data showed discoloration or brown of the fresh meat was occourred at the beginning of the cooling storage with decrease of metmyoglobin reductase activity so soon, especially from 1to 5-day. The key indexs were a* and L* value for the change of meat colour..

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