

Analysis of Oxy- and Metmyoglobin in Beef Chuck by Absorption Spectrophotometer and Hunter-Lab.

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Hunter-Lab와 分光光度計에 의한 쇠고기의 Oxy-와 Metmyoglobin의 分析

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Summary

Oxy- and metmyoglobin concentrations in beef chuck were measured by Hunter-Lab and spectrophotometer.

The values of oxymyoglobin by Hunter- Lab got 34.03, 10.40, and 6.50 as average in L, a, and b while the CIE color primaries were 13.33, 11.58, and 9.94 in X, Y, and Z, respectively. The metmyoglobin values recorded 39.10, 13.20, and 10.13 in L, a, and b, of which values were converted to 17.88, 15.29, and 11.40 in X, Y, and Z of the CIE primaries.

Absorption spectrum of oxymyoglobin showed 2 peaks which were 0.79 and 0.83 of extinction coefficient with 530 and 570nm in wavelength, and that of metmyoglobin appeared on an irregular curve with a summit of 0.58 and 500 in extinction coefficient (cm² / mg) and wavelength(nm) each.

Introduction

Many current methods used for examination of meat pigments employ the reflectance spectroscope. However, since the extent of penetration and the total absorption of the oxygen is a very important for the color development of myoglobin, it is more appropriate to reexamine the existing techniques based on pigment extraction.

Thus the present study details the deter-

mination of oxy- and metmyoglobin concentration by using a simple spectrophotometric method and Hunter-Lab which measures a visible color.

Materials and Methods

Beef chuck purchased in grocery was sliced to adjust it to Hunter-Lab as a size of 7cm in length, 7cm in width and 2cm in thick, and exposed in air for 5 hours to develop a bright red which is a color of

oxymyoglobin. For metmyoglobin the sample's surface was cut out 1 cm in thick. At that time the surface color of beef was a brownish red which represented the color of metmyoglobin. The measurement of oxy- and metmyoglobin was repeated 3 times by using Hunter-Lab and got average scores.

The pigments in beef chuck were extracted by blending the weighed 40 to 60g samples with 80ml of phosphate buffer of pH 6.0 and I 0.2.

The resulting slurry was centrifuged for 30mins at 3°C and 15,000g.

Usually a clear, nonturbid supernatant was obtained, and a spectrophotometer, Bochringer, was used to get the spectrum of this solution which was recorded between 500 to 700nm in wavelength.

Any deoxymyoglobin initially present was observed as oxymyoglobin since it became oxygenated during the extraction process.

Results and Discussion

Table 1 shows the L, a and b values of oxymyoglobin in beef chuck, of which values mean the dimension of lightness, red to green color, and yellow to blue color, respectively, in Hunter-Lab color space. And Table 2 means the conversion of the Hunter-Lab values into CIE primaries X, Y and Z.

Table 1. Oxymyoglobin color measurement of beef chuck by Hunter-Lab adjusted with a pink tile.

Repeat:	1	2	3	Average
L	34.40	34.20	33.50	34.03
a	10.10	10.50	10.60	10.40
b	6.30	6.70	6.60	6.50

Table 2. Oxymyoglobin color measurement of beef chuck, which was obtained by conversion of the Hunter-Lab values into CIE primaries X, Y and Z.

Repeat:	1	2	3	Average
X	13.54	13.48	12.98	13.33
Y	11.83	11.70	11.22	11.58
Z	10.31	10.00	9.52	9.94

Metmyoglobin color measurements of beef chuck by Hunter-Lab and CIE primaries are shown in Table 3 and 4 each.

Table 3. Metmyoglobin color values of beef chuck by Hunter-Lab adjusted with a pink tile.

Repeat:	1	2	3	Average
L	39.20	39.00	39.10	39.10
a	13.00	13.20	13.40	13.20
b	10.00	10.10	10.20	10.13

Table 4. Conversion of the Hunter-Lab values of metmyoglobin into primaries X, Y and Z.

Repeat:	1	2	3	Average
X	17.92	17.79	17.92	17.88
Y	15.37	15.21	15.29	15.29
Z	11.54	11.32	11.33	11.40

The absorption spectra of oxymyoglobin and metmyoglobin are shown in Figure 1.

This spectrophotometric method is simple and has an advantage of not requiring special attachments, though it is not as rapid as a direct reflectance spectrophotometry. As shown in Figure 1, the pigment of oxymyoglobin observed were stable over a span of hours and, since the extraction required less than 2 hours, could be con-

-sidered as an accurate reflection of the distribution of oxymyoglobin at the time of extraction, because all the uncomplexed myoglobin were converted to the oxygenated form as a result of aeration during the extraction process.

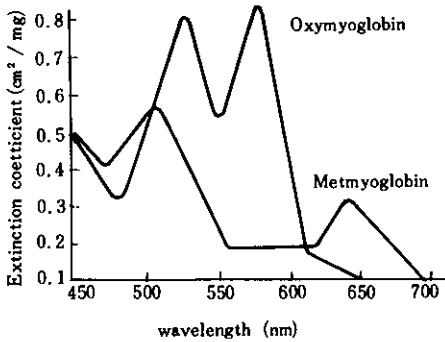


Fig. 1. Absorption spectra of oxy- and metmyoglobin in beef chuck.

적 요

소고기의 Chuck부위에 존재하는 색소중 Oxy-와 Metmyoglobin의 농도를 알기 위하여 Hunter-Lab와 분광광도계를 사용하였다.

Hunter-Lab에 의한 Oxymyoglobin의 농도는 L, a 그리고 b에서 각각 34.03, 10.40, 그리고 6.50으로 측정되었으며 이들 수치는 CIE Primaries로서는 각각 X, Y 그리고 Z에서 13.33, 11.58 그리고 9.94로 환산되었다.

또 Hunter-Lab에 의한 Metmyoglobin은 L, a 그리고 b에서 39.10, 13.20 그리고 10.13의 수치를 보여줬으며, CIE primaries에서는 17.88, 15.29와 11.40이 X, Y와 Z로 각각 환산되었다.

Oxymyoglobin의 Spectrum은 Extinction Coefficient (cm^2/mg)에서 0.79와 0.83의 수치를 가진 2개의 Peak가 파장 530과 570 nm에서 각각 나타났으며 Metmyoglobin의 경우는 Extinction Coefficient에서 0.58 그리고 파장이 500인 peak를 보이면서 불규칙한 곡선을 보여 주었다.

Literature Cited

1. Dean, R.W. and C.O. Ball. 1960. Food Technol. 12: 65
2. Franke, K.W. C. and M. Solberg. 1971. J. Food Sci. 36: 271
3. Goldbloom, D.E. and W. D. Brown. 1966. Biochem. Biophys. Acta. 112: 584.
4. Saffle, R.L. 1973. J. Food Sci. 38: 968.
5. Satterlee, L.D. and W. Hansmeyer. 1974. J. Food Sci. 39: 305.
6. Snyder, H.E. 1965. J. Food Sci. 30: 457.
7. Snyder, H.E. and D. J. Armstrong. 1967. J. Food Sci. 32: 241.
8. Stewart, M.R., M.W. Zipser and B. M. Watts. 1965. J. Food Sci. 30: 464.
9. Strange, E. D., R.C. Benedict and R. E. Gugger. 1974. J. Food Sci. 39:988.