PE7.41 Effect of different blooming times on colour parameters and reflectance spectrum of beef
386.00

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I INTRODUCTION

Clour is an important factor of meat quality: in fact many consumers make purchase decision based on displayed colour and discriminate meat which is not red and bright [1]. Colour is mainly influenced by the myoglobin pigment content and its physico-chemical [2]. The iron atom may exist in different oxidation states caused by exposure during meat storage to atmospheric conditions [3]. To determinate meat colour, several research exposed meat samples to air for 30 minutes [4] or 1 h [5] to allow the blooming effect and to obtain oxymyoglobin from deoxymyoglobin [6] whilst other researches exposed meat on air for 90 minutes [7]. Few authors studied the effect of blooming time on reflectance spectrum of deoxymyoglobin, oxymyoglobin and metmyoglobin and their trend during time. The aim of this study was to evaluate the effect of the blooming time on colour indices measurements and on reflectance spectrum, utilizing Longissimus thoracis muscle of young bull.

II MATERIALS AND METHODS

The experiment was carried out on Longissimus thoracis muscles (Lt) taken between 12th and 13th rib of 17 young bulls aged between 16 and 18 months. All animals were slaughtered by throat cut after captive bolt stunning and dressed in the normal manner. After 8 days of ageing, Lt muscle was removed. The colour was measured using spectrophotometer Minolta CM-2600d, after calibration against a white plate, used including specular reflectance by D65 illuminant, according to [6], and CIE colour scale [8]. The three fundamental outputs were L* (lightness), a* (red index), and b* (yellow index); hue angle defined as tan-1(b/a) and chroma defined as (a2+b2)1/2 were also measured. Moreover the perceptions of the different colours were analysed using the differences of CIELab parameters between exposure times, using the following equation $\Delta E=(\Delta L^{*2}+\Delta a^{*2}+\Delta b^{*2})1/2$; if the value obtained is > 5 human eye can distinguish the samples of different colour [9] The effect of blooming time on colour measurement was evaluated immediately after cutting (0 min) and after 30, 60, 90, 120 min of exposure to air after cut at about 3±1 °C. Also reflectance spectra between 360 and 740 nm by steps of 10 nm were measured to determinate differences in spectral measures trend, metmyoglobin percentage (MetMb%) and oxymyoglobin percentage (OxyMb %) as reported in [10]. Furthermore to determinate the differences among particular spectra tracts the area under these for each curve was integrated. Data were analysed using variance analysis performed with GLM procedure and Principal Component Analysis (PCA) was performed on the colour data set to provide a partial visualization of the correlation between colour variables. [11].

III. RESULTS AND DISCUSSION

The effects of blooming time on colour parameters are showed in table 1. It had a lesser effect on L* value than a* and b* values: in fact the first parameter showed a significant difference by 30' of exposure to air ($P< 0.031$). These results were confirmed also by [12] referring that blooming time had no effect on L* values and also on the hue angle on a period over 30 minutes. The a* and b* values increased during blooming time but there were significant differences only between 0 and 120 minutes for b* value (13.26 vs 15.94 respectively) and among 0, 30 and 120 minutes for a* value (12.12, 14.67, 16.98 respectively). These results showed that the blooming time had limited effects on beef colour after 30 minutes in accordance with Lee et al. 2007 [13] . During blooming time the content of OxyMb increased whilst the MetMb decreased until 60 minutes ($P<0.01$). Analyzing the areas (table 3), no differences were found between 610-680 nm, whilst significant differences were found between 420-530 nm ($P<0.006$) and 540-580 nm ($P<0.05$). In particular both areas were different only at 0 minute. This trend was confirmed also by PCA analysis. PCA1 explain 84% of variance and it discriminated only 1 group that is 0 min (PCA score, figure 1) and areas parameter (PCA loading,

figure 2) absorbed the maximum variability. ΔE (table 4) showed significant differences only among 0 minute and all the others parameters with an average datum of 7.3 that determined a visible colour difference for human eye.

IV CONCLUSION

In conclusion these results indicated that to obtain a sufficient blooming time an exposure to air longer than 30 minutes is needed, but if we want to obtain the most stable and repeatable colour measurement on fresh cut beef about 120 minutes of exposure on air are required, particularly if we want to use the spectral data.

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Figure 1. Project of PCA score

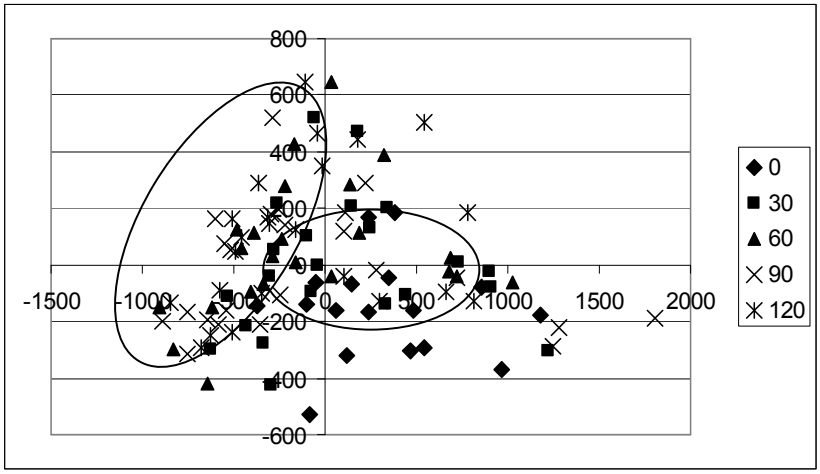

Figure 2. Project of PCA loading

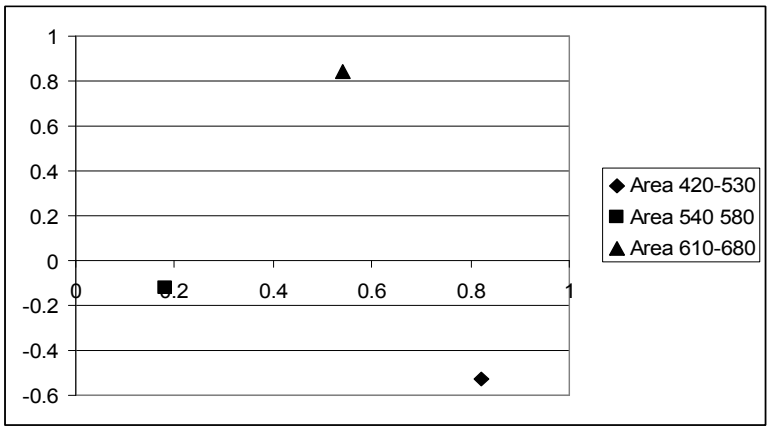

Table 1: Effect of bloom time on colour parameters

Times min	L*	a*	b*	C	H
0	46.77a	12.12c	13.26b	18.01c	47.65a
30	45.33ab	14.67b	14.88b	20.96bc	45.70ab
60	44.23b	16.27bc	15.59b	22.58b	44.02b
90	44.24b	15.90bc	15.22b	22.07bc	43.93b
120	44.02b	16.98a	15.94a	23.36a	45.50b
Means	44.80	15.37	15.08	21.60	44.80
RMSE	3.623	2.756	1.727	2.837	4.250

(a,b,c,: P<0.05)

Table 2: Effect of blooming on pigment content

Times min	% Deoxy ($K/S_{474/525}$)	% OxyMb ($K/S_{610/525}$)	% MetMb ($K/S_{572/525}$)
0	1.13	2.25bc	0.74a
30	1.15	2.76bc	0.69ac
60	1.16	2.82a	0.70bc
90	1.15	2.57bc	0.70bc
120	1.15	2.73c	0.71b
Means	1.15	2.64	0.70
RMSE	0.078	0.368	0.052

(a,b,c,: P<0.05)

Table 3: Integral of different reflectance spectra tracts

Times min	420-530 nm	540-580 nm	610-680 nm
0	2047.48a	501.62a	2614.60
30	1768.33ab	446.78ab	2599.73
60	1590.57b	416.22b	2563.25
90	1651.35b	424.92b	2515.99
120	1537.20b	409.63b	2571.87
Means	1699.41	436.19	2570.81
RMSE	448.47	103.856	364.50

(a,b,c,: P<0.05)

Table 4: Evaluation of ΔE among different exposure times

	30 min	60 min	90 min	120 min
0’	6.3±2.85	7.5±3.24	7.6±2.57	7.9±3.19
30’		2.41±0.87	2.86±1.51	3.16±1.13
60’			2.40±1.24	2.24±1.28
90’				3.10±1.75

Means ± dev. Standard