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INVESTIGATION OF THE COLOUR OF PAPRIKA POWDERS STORED IN DIFFERENT CONDITIONS

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Abstract

We studied how the colour coordinates of paprika grist changed during storage, using different storage conditions. Different quality paprika powders were investigated. The different quality paprika powder samples were stored in fridge, in dark place using 23°C, and also at room temperature using transparent packing and at room temperature packed in tinfoil. The colour coordinates of samples were determined using the CIELab colour system measured by MINOLTA CR-300 tristimulus colorimeter once a week via six months. We appointed, that L increased significantly after 2 weeks in room temperature, while change began only after 1 month in fridge and in dark place using 23°C. The a* coordinate of samples stored in fridge didn't decrease significantly. In case of samples stored at the other conditions a* permanently lifted after 15 weeks. The value of b* began to rise significantly after 9 weeks. Their change was more with 1 unit in room temperature in 6 months, than in case of samples stored in fridge and in dark place. The colour differences between values measured at first and in the different times were calculated. ΔE^*_{ab} value was more than 1,5 – it is the difference, that visible– after 12 weeks in case of samples stored in fridge and in dark place using 23°C and was more than 1,5 in case of samples stored in room temperature after 9 weeks.*

Key words: (maximum 6): papika powder, colour coordinates, colour measurement

INTRODUCTION

The use of natural food colours is preferred to that of artificial dyestuffs for modern alimentary purposes. Paprika is a spice plant grown and consumed in considerable quantities world-wide, and also used as a natural food colour. Hungarian paprika powder is still regarded as a ”Hungaricum” today. Paprika is cultivated in areas of the world such as Spain, China, South Africa and South America, where the weather is favourable for the growth of this plant and for the development of its red colouring agents. The large number of hours of sunshine allows the paprika to ripen on its stock, so that the basic material reaching the processing mills has a high dyestuff content. Hungarian paprika has a unique aroma and a specific smell, but the production of powder with a good red colour is a considerable problem. The colour of paprika powder is very important, because the consumer concludes its colouring power based on its colour.

The colouring power is determined by quality and quantity of colouring agent of paprika squarely, but the colour of the powder is influenced by many factors besides the colouring agent content. The colour of the powder is influenced by its particle size, oil content and moisture content and first of all the colour agent content. The instrumental colour measurement isn't used in the industrial practise, the development of the colour of the paprika powder is made based on the empirical facts; therefore the quantity of the colour of the final-product often isn't correct.

Since the 1970s a number of papers have been published on measurements of the colour of paprika powders (Horváth és Kaffka, 1973, Drdak et al., 1980, Huszka et al., 1984, Drdak et al., 1989). Measurements have been performed relating to the changes in the colour stimulus components X, Y and Z of powders during mixing (Huszka et al., 1984) and to the correlation between visual sensing and the instrumentally measured colour characteristics (Huszka et al., 1985, H.Horváth, 2007b). The effects of ionizing irradiation on the colour of paprika powder were investigated by Fekete-Halász et al. (1996). Minguez et al. (1997) analysed how the colour of the powder is changed by the ratio of the yellow and red pigments within the total colouring agent content. There are many papers about the changes in the colour characteristics of the paprika during different dryings and storage processes (Park et al., 2007, Banout et al., 2011, Topaz et al., 2011, Chetti et al., 2012).

In case of the Korean cultivars, no significant change in colour characteristics was detected when the moisture content varied between 10% and 15% (Chen et al., 1999). H.Horváth and Hodúr (2007a) investigated hungarian paprika powders and depicted that the colour of the powder was observed turning into darker and deeper red while increasing moisture content. Various investigations have been made of the connection between the colouring agent content of the powder and the colour characteristics measured by different techniques (Navarro et al., 1993, Nieto- Sandoval et al., 1999).

Such investigations have yielded partial results, but there is no formula that describes the correlation between the colouring agent content and the colour characteristics.

Now we studied how the colour coordinates of paprika grist changed during storage, using different storage conditions.

MATERIAL AND METHOD

Characterization and measurement of the colour

Colour measurements were performed with a Minolta CR-300 tristimulus colour measuring instrument. The CIELab colour system was used for colour characterization. In this colour space the colour points are characterized by three colour coordinates. L^* is the lightness coordinate ranging from no reflection for black (L^*=0) to perfect diffuse reflection for white (L^*=100). The a^* is the redness coordinate ranging from negative values for green to positive values for red. The b^* is the yellowness coordinate ranging from negative values for blue and positive values for yellow.

The total colour change is given by the colour difference (ΔE^*_{ab}), in terms of the spatial distance between two colour points interpreted in the colour space: (Hunter, 1987)

$$\Delta E^*_{ab} = \left[\left(L^*_1 - L^*_2\right)^2 + \left(a^*_1 - a^*_2\right)^2 + \left(b^*_1 - b^*_2\right)\right]^{1/2}. \qquad (1)$$

If 1.5< ΔE^*_{ab}<3, then the colour difference between two paprika grists can hardly be visually distinguished, if ΔE^*_{ab}>3, then the colour difference between two paprika grists can be visuall distinguished (H.Horváth, 2007b).

The chroma $\left(C^*_{ab}\right)$ was used to determine the change of colour.

$$C^*_{ab} = \left(\left(a^*\right)^2 + \left(b^*\right)^2\right)^{\frac{1}{2}} \qquad (2)$$

The chroma represents colour saturation which varies dull at low chroma values to vivid colour at high chroma values (Hunter,1987).

The equations used to describe the hue difference (ΔH^*_{ab}) between two colour points are as follows:

$$\Delta H^*_{ab} = \mathrm{sign}\left(a^*_1 \cdot b^*_2 - a^*_2 \cdot b^*_1\right) \cdot \left(\left(\Delta E^*_{ab}\right)^2 - \left(\Delta L^*\right)^2 - \left(\Delta C^*_{ab}\right)^2\right)^{\frac{1}{2}} \qquad (3)$$

The measured paprika powder samples and the storage conditions

We examined 10 types of paprika with different quality from Hungary, South-America and South-Africa. The colour agent content of samples changed from 81 ASTA unit to 183 ASTA unit. The powders were stored 4 different storage conditions:

- in fridge,
- in dark place using 23°C,
- at room temperature using transparent packing,
- at room temperature packed in tinfoil.

The colour coordinates of samples were measured once a week via six months.

RESULTS AND DISSCUSIONS

To establish whether the storage time and storage condition influences the colour-characteristics analysis of variance (ANOVA) was performed. The result of the Bartlett and Cochran-test confirmed the homogeneity of the variances, the Shapiro-Wilk test was applied to control the normality.

The result of ANOVA is shown in Table 1. We can see, that the storage time and storage condition influenced the value of the L*, a*, b* colour coordinates significantly.

Table 1

The result of ANOVA

Factor	Colour coordinate	F value	Significant level
Storage condition	L*	2,71	0,045
	a*	2,84	0,041
	b*	2,52	0,051
Storage time	L*	14,2	0,000
	a*	3,28	0,003
	b*	3,22	0,000

Effect of the storage time

In the Fig. 1 we can see the effect of the storage time on the lightness coordinate L*. The L* lightness coordinate increased during storage, after 26 weeks the change was 2 unit. This means that the powders became lighter during the storage.

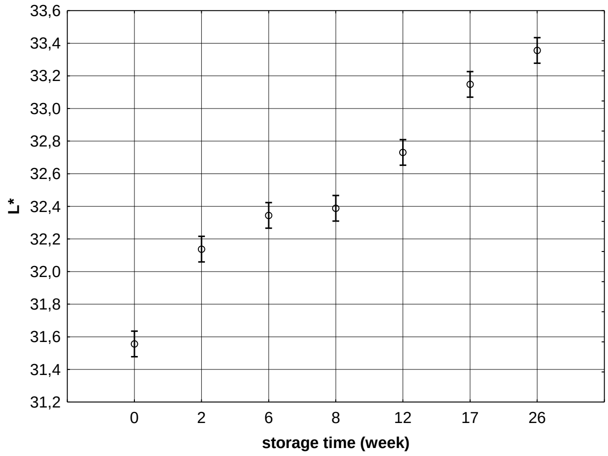

*Fig. 1 The effect of the storage time on the lightness coordinate L**
(averages with conf. int. át a level 95%)

In the Fig. 2 we can see the effect of the storage time on the redness coordinate a*. The a* redness coordinate decreased during storage, after 26 weeks the change was 1,5 unit. This shows that the powders became less red during the storage.

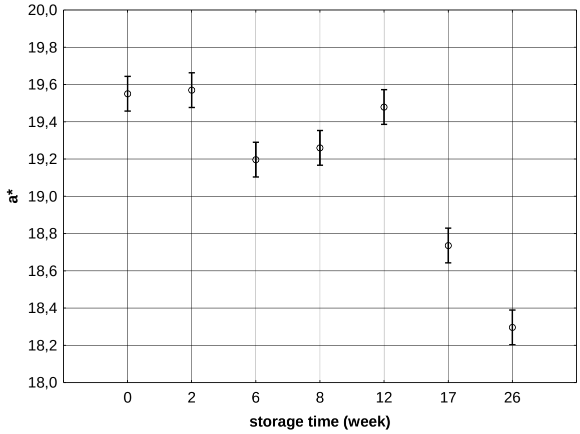

*Fig. 2 The effect of the storage time on the redness coordinate a**
(averages with conf. int. át a level 95%)

The Fig. 3 shows the effect of the storage time on the yellowness coordinate b*. The b* yellowness coordinate decreased during storage, after 26 weeks the change was 1 unit. This shows that the powders became more yellow during the storage.

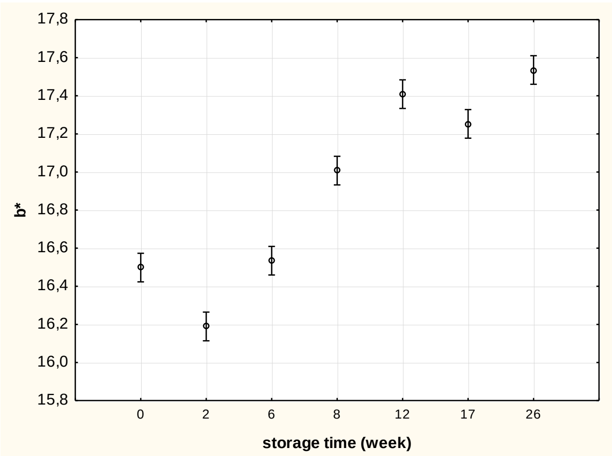

*Fig. 3 The effect of the storage time on the yellowness coordinate b**
(averages with conf. int. át a level 95%)

Effect of the storage time

The Fig. 4 shows the effect of the storage condition on the lightness coordinate L*. We can see that the samples which were stored in room temperature, in tinfoil became lighter significantly, the change was the least in the case of powders stored in the fridge.

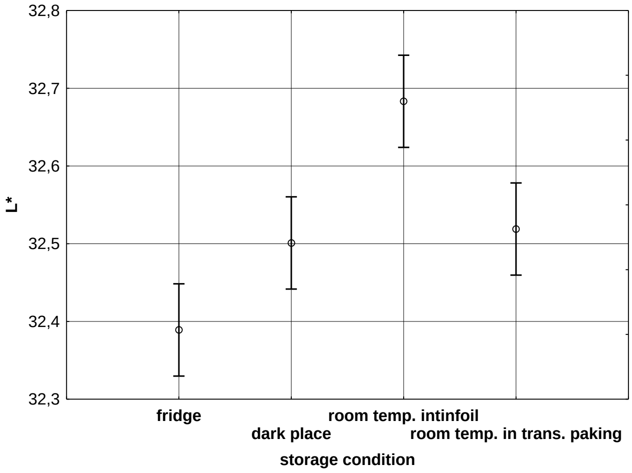

*Fig. 4 The effect of the storage condition on the lightness coordinate L**
(averages with conf. int. at a level 95%)

The Fig. 5 shows the effect of the storage condition on the redness coordinate a*. The figure shows that the a* coordinate of samples that were stored in fridge was the highest. This means that these powders were more red.

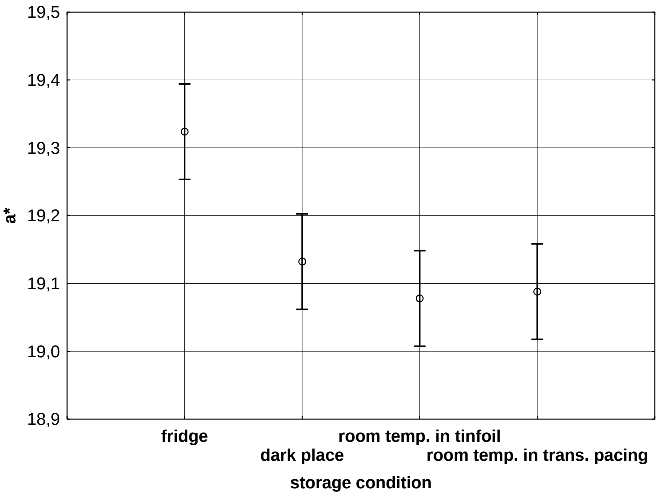

*Fig. 5 The effect of the storage condition on the redhtness coordinate a**
(averages with conf. int. at a level 95%)

The Fig. 6 shows the effect of the storage condition on the yellowness coordinate b*. The figure shows that the b* coordinate of samples that were stored in fridge was more yellow. This means that these powders became least yellow.

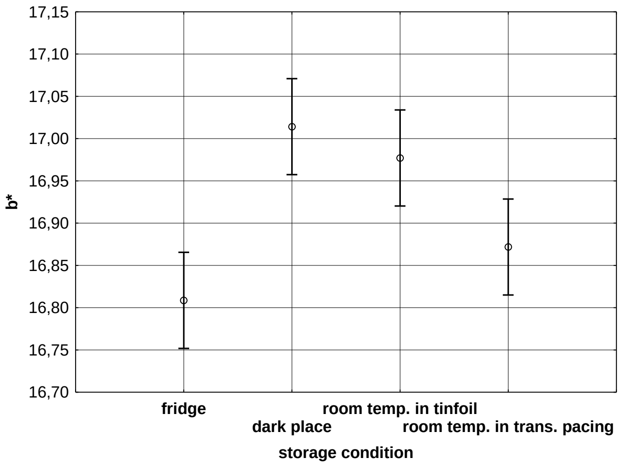

*Fig. 6 The effect of the storage condition on the yellowness coordinate b**
(averages with conf. int. at a level 95%)

CONCLUSIONS

- The storage time has significant effect on the value of the L*, a*, b* colour coordinates.
- The storage condition has significant effect on the value of the L*, a*, b* colour coordinates.
- The change of paprika colour after 26 weeks was visible, its colour of paprika powders becomes lighter, less red and more yellow.
- The change of paprika colour was the least in the case of samples stored in fridge.

REFERENCES

1. Chetti M.B., G. T. Deepa, Roshny T. Antony, Mahadev C. Khetagoudar , Dodappa S. Uppar , Channappa M. Navalgatti (2012), Influence of vacuum packaging and long term storage on quality of whole chilli (Capsicum annuum L.), J Food Sci Technol, DOI 10.1007/s13197-012-0763-3

2. Banout J., P. Ehl J., Havlik B. Lojka, Z. Polesny, V. Verner (2011), Design and performance evaluation of a Double-pass solar drierfor drying of red chilli (Capsicum annum L.), Solar Energy, Vol. 85, pp. 506–515.

3. Chen Q., Hak-kyun-koh., Jae-Bok-Park., (1999**),** Color evalution of red pepper powder. Transaction-of-the-ASAE, Vol. 42(3), pp. 749-752.
4. Drdak M., Sorman L., Zemkova M., Schaller A., (1980), Ergebnisse von Studien über den Zusammenhangzwischen Zusammensetzung und Farbe von gemahlenem Gewürzpaprika. Confructa, Vol. 25(3/4), pp. 141-146.
5. Drdak M., Greif G., Kusy P., (1989), Comparasion between the sensory and spectrophotometric method for determination of colour of paprika powder. Nahrung, Vol. 33(8), pp. 737-742.
6. Fekete-Halász M., Kispéter J., (1996), Effect of irradiation on colour of ground red paprika, Acta Alimentaria Vol. 25(2), 189-193.
7. H.Horváth Zs., C. Hodúr (2007a), The colour of paprika powders with different moisture content, International Agrophysics, Vol. 21, pp. 67-72.
8. H.Horváth Zs. (2007b), Procedure for setting the colour characteristics of paprika grist mixtures, Acta Alimentaria, Vol. 36, pp. 75-88.
9. Horváth L., Kaffka K., (1973), Instrumental Colorimetry of Red-pepperGrist, Mérés és Automatika, Vol. 21(9), pp. 341-348.
10. Hunter R., (1987), The measurement of appearance, Wiley Press, New York
11. Huszka T., Halászné Fekete M., Horváth M. Zs., Lukács Gy. (1984), Számítógépes színrecept számítási eljárás fűszerpaprika őrlemények optimalizált előállítására, Mérés és Automatika, Vol. 32(5), pp. 170-177.
12. Huszka T., Halász-Fekete M., Lukács Gy. (1985), Colour Tolerance of Red-Pepper Powders, Hungarian Scientific Instruments, Vol. 60, pp. 43-47.
13. Huszka, T., Horváth Zs., Halász-Fekete M., Véha A., Gyimes E. (1990), Computer aided quality planning and production control of red-pepper powders, 4th European Seminar of the EOQ Food Section, Berlin, Procedings, pp. 176-178.
14. Minguez-Mosquera M. I., Perez-Galvez A. (1997), Color quality in paprika oleoresins, Journal of Agricultural and Food Chemistry Vol. 46 (12), pp. 5124-5127.
15. Park, Jae Hee; Kim, Chang Soon (2007), The stability of color and antioxidant compounds in paprika (Capsicum annuum L) powder during the drying and storing process, Food Science and Biotechnology, Vol. 16(2) pp. 187-192.
16. Ayhan Topuz, Cuneyt Dincer, Kubra Sultan Özdemir, Hao Feng, Mosbah Kushad (2011), Influence of different drying methods on carotenoids and capsaicinoids of paprika (Cv., Jalapeno), Food Chemistry Vol.129 pp. 860–865