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THE VARIATION OF COLOUR OF PAPRIKA POWDERS WITH ADDED OLEORESIN

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Abstract

The paprika oleoresin, that is an oil soluble extract from the fruits of Capsicum Annum Linn or Capsicum Frutescens, is used often to raise the colour agent content of paprika powders. We investigated how the colour agent content and colour of paprika powder samples with added oleoresin changes in the course of storage. The colour agent content of 9 different quality powders was increased by 2-66 % using oleoresin. The initial colour agent content of samples changed between 59 and 167 ASTA unit. The powders were made from Hungarian, Chinese and Chinese germ-reduced paprika. The colour agent content of samples was measured through 6 months. The measured values were analysed using ANOVA. The quantity of added oleoresin didn't influence the colour agent content decrease significantly, but the initial paprika powder and storage time affected it significantly. The decrease of colour agent content varied between 8 and 35 percent, the average reduction was more in case of Hungarian powders. The values of colour difference changed between 2 and 6 units. The initial paprika powder influenced the variation, but the quantity of added oleoresin didn't have significant effect. The colour difference values exceeded the perceptible 3 unit in case of samples made of Hungarian paprika, the value of colour differences changed between 3-6 units. The colour differences were between 1.5 and 3 units for all samples in case of Chinese paprika and Germ-reduced Chinese paprika. The colour of paprika powders became brighten and less red after 6 month. The change was more robust in case of Hungarian paprika powders.

Key words: paprika, colour agent content, oleoresin, colour coordinates

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. The colouring power of paprika powders is determined by quality and quantity of colouring agent of paprika squarely. The colour agent content of powders decreases in the curse of storage and is influenced by steps of the processing. The dehydration is the most critical step of the processing. The effect of the heat impairs the colour agent, aroma and flavour substratum of paprika. Several researchers investigated the optimal parameters of dehydration. (Minguez-Mosquera et al., 2000; Shin et al., 2001; Doymaz and Pala, 2002; Kim et al., 2004). Topuz et al. (2009) compared the Refractance Window (RWD) method to dry paprika in comparison with freeze drying, hot-air oven drying, and natural convective drying methods. It was depicted that the least colour agent content decrease was in the case of natural convective drying method. The colour agent content reducing is effected by condition of storage. There are many papers about the changes in the colour agent content of the paprika storage processes (Park et al., 2007, Banout et al., 2011, Topuz et al., 2011, Chetti et al., 2012). 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., 1989). Measurements have been performed relating to the correlation between visual sensing and the instrumentally measured colour characteristics (Huszka et al., 1985, H.Horváth, 2007). 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, Topuz 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 és Hodúr (2007) 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.

The paprika oleoresin, that is an oil soluble extract from the fruits of Capsicum Annum Linn or Capsicum Frutescens, is used often to raise the colour agent content of paprika powders. We investigated how the colour agent content and colour of paprika powder samples with added oleoresin change in the course of storage.

MATERIAL AND METHOD

Materials

The colour agent content of 9 different quality powders was increased. The initial colour agent content of samples changed between 60 and 167 ASTA unit. The powders were made from Hungarian, Chinese and gern-reduced Chinese paprika. The colour agent content was increased using 0.5 g-2.0 g oleoresin added to 100 g paprika powder. In Table 1 shows the investigated powder samples, their initial colour agent content and the quantity of added oleoresin.

Table 1

The parameters of paprika powder samples

Samples	Initial colour agent content (ASTA unit)	Added oleoresin (g)			
Hungarian paprika (H1)	115	0.5	1.0	1.5	2.0
Hungarian paprika (H2)	134	0.5	1.0	1.5	2.0
Hungarian paprika(H3)	167	0.5	1.0	1.5	2.0
Hungarian paprika (H4)	60	0.5	1.0	1.5	2.0
Chinese paprika (C1)	77	0.5	1.0	1.5	2.0
Chinese paprika (C2)	91	0.5	1.0	1.5	2.0
Chinese paprika (C3)	144	0.5	1.0	1.5	2.0
Germ-reduced Chinese paprika (GC1)	93	0.5	1.5		
Germ-reduced Chinese paprika (GC2)	133	0.5	1.5		

Measurement of colour agent content

After homogenization of powders the colour agent content of samples was measured. The ASTA (American Spice Trade Association) unit was used to give the colour agent content of paprika powders according to MSZ EN ISO 7541. The acetone extracts of paprika powder was measured by photometer at 460 nm. The ASTA unit was calculated using following formula:

$$\text{ASTA} = \frac{\text{Absorbance} \cdot 16{,}4 \cdot \boldsymbol{f}}{\text{weight of sample (g)}},$$

where $\boldsymbol{f}$ is a correction factor for the used photometer.

Measurement of colour

Colour measurements were performed with a HunterLab MiniScan 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 (Hunter, 1987). 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:

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

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 visually distinguished (H.Horváth, 2007).

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

The chroma (2) represents colour saturation which varies dull at low chroma values to vivid colour at high chroma values. The hue difference (3) was used to evaluate the change of shade.

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

The samples were stored in room-temperature, protected from light. The colour coordinates and colour agent content were measured monthly for 6 months.

RESULTS AND DISCUSSION

The change of the colour agent content

To evaluate the change of colour agent content we calculated the value of decrease of colour agent content measured at different times correlated to initial value. The values were given in percent. First we analysed how the colour agent content decreased influenced by the initial paprika powder, storage times and the quantity of added oleoresin. The ANOVA was applied.

Table 2

Variance table in case of colour agent content decrease

Factor	F value	Significant level
Quantity of added oleoresin	0.53	0.717
Storage time	78.11	0.000
Initial paprika powder	52.65	0.00

The result of ANOVA is shown in Table 2. It can be established that the quantity of added oleoresin didn't influence the colour agent content decrease significantly, but the initial paprika powder and storage time affected it significantly. In Fig. 1 we can see the averages decrease during storage with confidence interval at a level 95%. The Fig. 1 shows that the colour agent content of paprika powders after a period of 6 months reduced by 26 % averagely. In Fig. 2 we can see the effect of initial powders. The decrease of colour agent content varied between 8 and 35 percent. It can be seen good that the reduce was mostly in case of Hungarian paprika powders, and the loss was small for Chinese powders.

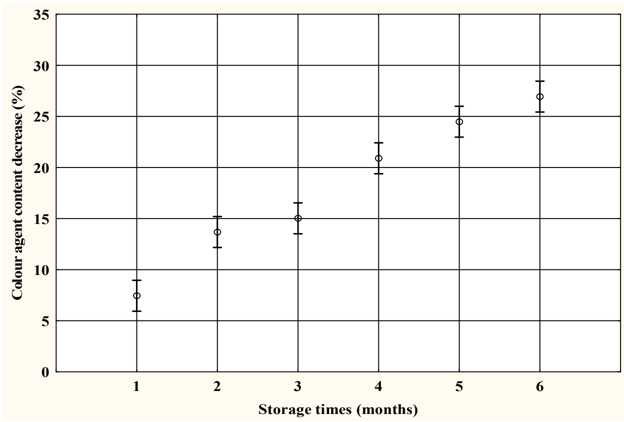

Fig.1. Results of ANOVA for colour agent content decrease, affect of storage time (average with confidence interval at a level 95%)

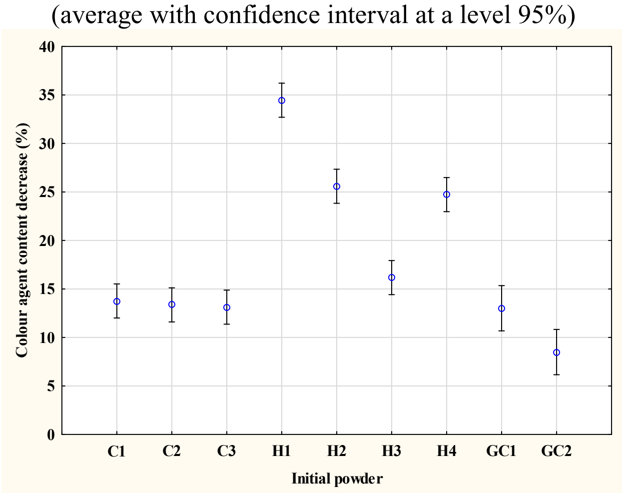

Fig.2. Results of ANOVA for colour agent content decrease, affection initial powder (average with confidence interval at a level 95%)

The change of the colour characteristics

To evaluate the change of colour we calculated the ΔE^*_{ab} colour differences values between colour coordinates measured at first and measured after 6 months. The values are shown on the Fig. 3-Fig. 4. for the different samples. We can see, that values of colour difference for initial samples (0g), and values of colour difference for samples with added oleoresin don't differ significantly. In Figure 3 we can see that the colour difference values exceeded the perceptible 3 unit in case of samples made of Hungarian paprika, the value of colour differences changed between 3-6 units. The colour differences were between 1.5 and 3 units for all samples in case of Chinese paprika and Germ-reduced Chinese paprika.

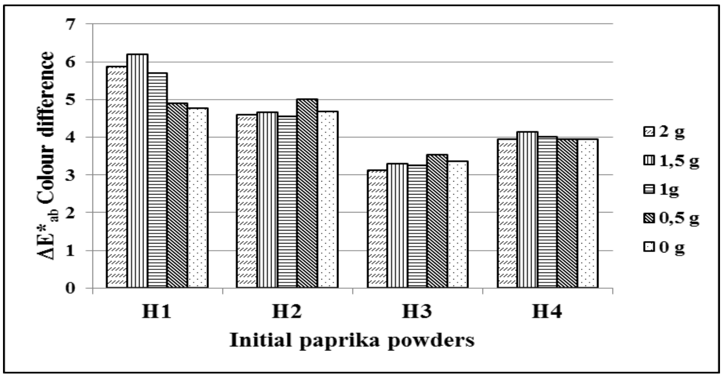

Fig. 3. ΔE^*_{ab} colour differences calculated between colour coordinates measured at first and after 6 months in case of Hungarian samples

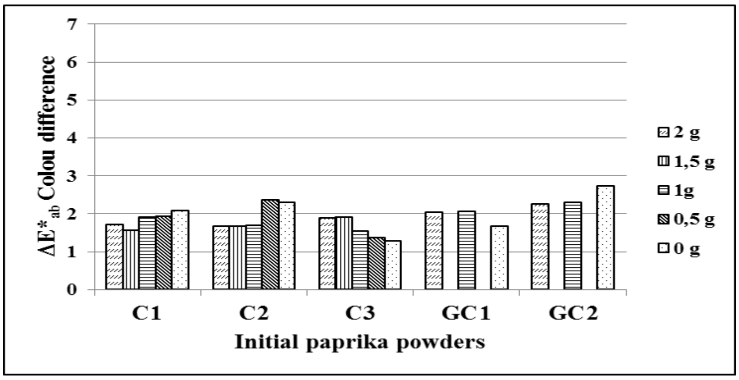

Fig. 4. ΔE^*_{ab} colour differences calculated between colour coordinates measured at first and after 6 months in case of Chinese samples

The ΔH^*_{ab} hue differences and ΔL^* lightness coordinate differences between colour coordinates were measured first and after 6 months were calculated to describe the direction of colour change. The values are given in Table 3 and 4. The ΔL^* lightness coordinate differences change between 0,18 and 3,3 unit and are positive. So the colour of powders became brighten. The values are higher in case of Hungarian paprika. The ΔH^*_{ab} hue differences values are positive, so the colour of powders was less red after 6 months. The change was more robust in case of Hungarian paprika powders. The quantity of added oleoresin didn't influence the the rate of the color deterioration.

Table 3

ΔL lightness coordinate differences calculated between colour coordinates measured first time and after 6 months

Initial powders	Quantity of added oleoresin				
	0 g	**0.5 g**	**1 g**	**1.5 g**	**2 g**
H1	3,12	3,15	2,90	3,28	3,31
H2	3,14	3,54	3,11	3,31	3,33
H3	2,63	2,88	2,45	2,64	2,53
H4	2,57	2,47	2,92	3,10	3,34
C1	1,62	1,35	0,95	0,67	0,99
C2	0,20	0,18	0,61	0,97	1,12
C3	0,35	0,75	1,13	1,62	1,09
GC1	0,96		1,51		1,76
GC2	2,26		1,62		1,77

Table 4

ΔH^*_{ab} hue differences calculated between colour coordinates measured first time and after 6 months

Initial powders	Quantity of added oleoresin				
	0 g	**0.5 g**	**1 g**	**1.5 g**	**2 g**
H1	3,52	3,76	4,48	4,66	4,32
H2	3,21	3,50	3,32	3,17	3,03
H3	2,05	2,02	1,88	1,73	1,45
H4	2,79	3,06	2,73	2,74	2,10
C1	1,14	1,06	1,66	1,41	1,40
C2	1,84	1,91	1,54	1,06	1,20
C3	1,22	1,13	1,05	0,39	0,28
GC1	1,38		1,39		1,06
GC2	1,41		1,15		1,40

CONCLUSIONS

The quantity of added oleoresin didn't influence the colour agent content decrease significantly, but the initial paprika powder and storage time affected it significantly. The decrease of colour agent content varied between 8 and 35 percent, the average reduction was more in case of Hungarian powders.

The colour of paprika powders became brighten and less red after 6 month. The change was more robust in case of Hungarian paprika powders.

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