HONEY CLASSIFICATION USING COLOUR MEASUREMENT

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Abstract: *The purpose of this work is to classify honey to their floral source based on their colour. For this study were chosen 15 samples of honey from different floral sources (5 samples of acacia, 5 samples of tilia and 5 samples of sun flower honey). The colour of honey is influenced by the floral source, due to the minerals and other minor components presented; exposure to heat and storage time may affect honey's colour. One of the easiest way to determine the honey colour is using the reflectance measurement in CIELab coordinates. The coordinates in CIELab dimension are L*, a* and b* values, which explain a 3-dimensional colour space. The L* value is the vertical axis and defines the lightness, and a* and b* values are perpendicular horizontal axes and define red-to-green and blue-to-yellow, respectively. In addition, hue angle (H) and colour intensity (C*) can be calculated from a* and b*. The honeys with the greatest purity of colour were the sun flower and tilia samples; the acacia samples exhibited the least purity of colour. The colour intensity of the samples is different from a floral source to another one. The sun flower sample had the highest colour intensity, followed by tilia and acacia honeys. All the colour parameters were significantly different.*

Keywords: *luminosity, colour intensity, hue angle*

1. Introduction

The colour of honey is one of its most variable features. Honeys show very different colours, varying from white or pale yellow to dark red or even black [1]. The colour of honey is characteristic of its floral source due to minerals and other minor components. Exposure to heat and storage time may affect honey's colour. Honey appears lighter in colour after it has granulated. The colour of a specific sample of honey, after it granulates depends on the crystal size. The final crystals give the lightest appearance. For this reason, most cremed honeys are opaque and light in colour. Honey can become darker as a result of storage, although at widely differing rates. This depends upon the composition of the honey (acidity, nitrogen, and fructose contents) and its initial colour. Generally, the darkening of honey is temperature sensitive and occurs more rapidly when honey is stored at high temperatures [2]. Many studies have dealt with the relation of honey colour to the floral origin, industrial processing methods, and the temperature and/or time of storage [3, 4, 5, 6]. In other study, the influence of the pollen grains, their morphology and colour, on the honeycolour has been considered [7].

However, in spite of the great importance of the colour of honey as an indicator of its origin and quality, there is no official method for its determination. Thus, as for other foods, the method proposed by the Organisation Internationale de la Vigne et du Vin [8] for the colourimetric analysis of grape-derived products, which is a simplification of the CIEYxy [9] with the CIE 1931 Standard Observer (2° visual field) based on the consideration of the whole visible spectrum, is used.

The *L**, *a**, and *b** values explain a 3-dimensional colour space. The *L** value is the vertical axis and defines the lightness, and *a** and *b** values are perpendicular horizontal axes and define red-to-green and blue-to-yellow, respectively. In addition, hue angle (H) and chroma (*C**) can be calculated from *a** and *b**. H is distributed in the 4 quadrants of the *a** and *b** plane, and *C** is higher the further it is from the origin of the coordinate [10].

The purpose of this work is to classify the honey (from different unifloral sources) based on the colour profile in CieLab coordinates.

2. Materials and methods

2.1. Materials

15 samples of honeys (5 samples of acacia, 5 samples of tilia and 5 samples of sun flower) were purchased from the local market of Suceava county. Before being used they were warmed up to 55 °C to dissolve any crystals, and kept in flasks at 30 °C to remove air bubbles that could interfere the colour studies.

2.3. Colour measurement

The colour measurement was achieved with using spectrometer Ocean Optics (USA). The samples were fitted in plastic flask with 3.8 cm height and 6 cm diameter. To measure the reflected light is opened a diagram of 8 mm. The reflection specters are registered and are calculated the CIELab parameters are calculated at a 100 angle, using the D65 light: L*(luminosity, between 0[black], at 100 [white]), a*(+a*[red], -a* [green]), b*(+b*[yellow], -b*[blue]) and h* [tone]. In figure 1 is presented the L*, h and C*.

The colour intensity C* (eq.1) is calculated as:

$$C^* = \sqrt{a^2 + b^2} \quad (1)$$

The hue angle (eq. 2) is computed as:

$$h = tan^{-1}(b^*/a^*) \quad (2)$$

In figure 1 is presented the L*, h and C*.

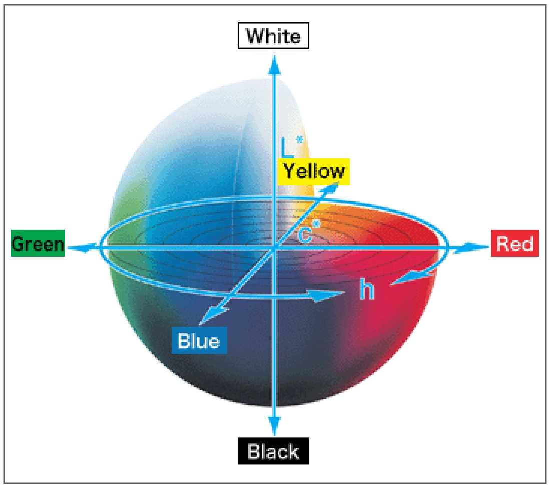

Fig.1. L*, C*, h* colour space [11]

2.7. Statistical analysis

An analysis of variance (ANOVA) (α=0.05) with least significant difference (LSD) test using Statgraphics Plus 5.1 were performed on the data colour parameters. The variables were weighted with the inverse of the standard deviation of all objects in order to compensate for the different scales of the variables.

3. Results and discussion

The colour of honey is different from a floral source to another one. To characterize the honey samples in terms of colour, they were plotted in their corresponding positions on the a*-b* and a*-L* colour spaces (Fig. 2 and 3). On the a*-b* colour space, the nearer a honey is to the origin, the less purity of colour it has, and the further away it from the origin it is, the greater its purity is. The honeys with the greatest purity of colour were the sun flower and tilia samples; the acacia samples exhibited the least purity of colour. Sun flower and tilia samples had the greatest yellow component (highest b* values). Sun flower and tilia samples had a high red component (a*), while the tilia sample had weak green component (-0.43, tab. 1).The diference between honeys in function of the components a* and b* are statistical semnificative (P<0.001). Figure 2 shows tilia and acacia honeys were clearer (higher L* value) than the other varieties. Sunflower honey is not so clear then the other ones (L* values are much smaller than in the case of acacia and tilia). The luminosity of honey samples was significantly different (P<0.001).

Tab.1.
Colour parameter of honey

Colour Parameter	Honey type			F-value
	Acacia	Sun Flower	Tilia	
L*	56.61a	44.88b	50.01b	7.13***
a*	-0.43c	6.13a	3.33b	18.66***
b*	17.76b	23.07ab	24.43a	3.39*
C*	17.89b	24.10a	24.88a	4.53*
h	-1.15b	-2.57b	3.36a	7.34**

The colour intensity of the samples is different from a floral source to another one. The sun flower sample had the highest colour intensity, followed by tilia and acacia honeys. The colour intensity could be influenced by the presence of the pigments from the floral source into the sun flower honeys. The colour intensity was significantly different (P<0.05).

The hue angle is significantly different (P<0.05) from a floral source to another one.

The highest hue angle is achieved in the case of tilia honeys, while the acacia and sun flower had a negative hue angle.

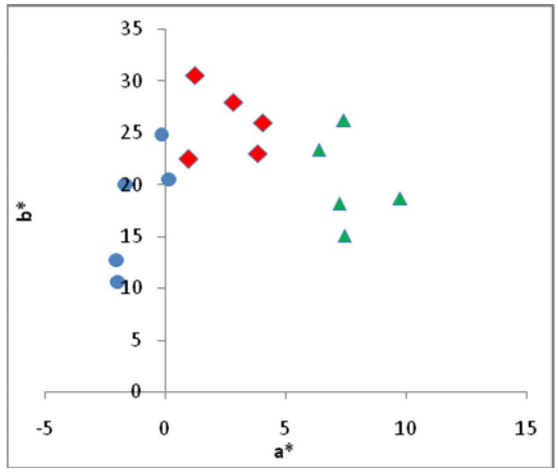

Fig.2. a*-b* colour components of honeys – blue circle acacia, red rhombus – tilia, green triangle - sunflower

The colour values obtained were within the expected ranges for each of the honeys studied. The most colour values reported in the literature generally correspond to measurements made by the Pfund scale (mm; [12, 13]). Although only a few studies had used CIELAB (L*, a*, b*) to measure colour in nectar and honeydew honey [14, 15] their results were similar to this study.

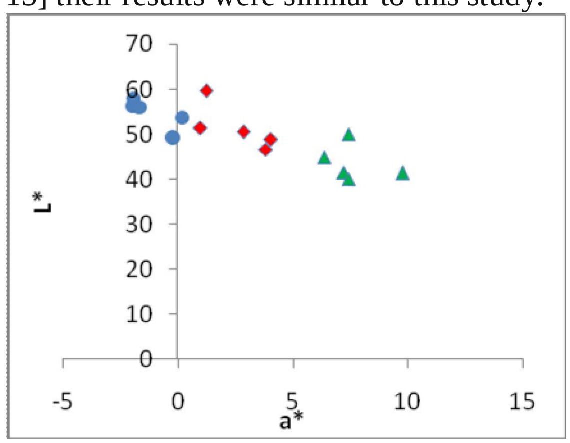

Fig.3. a*-b* colour components of honeys– blue circle acacia, red rhombus – tilia, green triangle – sunflower

4. Conclusion

The colour of honey could be chosen as reliable indicator of its floral origin. The honeys with the greatest purity of colour were the sun flower and tilia samples; the acacia samples exhibited the least purity of colour. Sun flower and tilia samples had the greatest yellow component (highest b* values). The sun flower sample had the highest colour intensity, followed by tilia and acacia honeys. The colour intensity could be influenced by the presence of the pigments from the floral source into the sun flower honeys. The highest hue angle is achieved in the case of tilia honeys, while the acacia and sun flower had a negative hue angle. All the colour parameter were significantly different.

5. References

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