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ANALYSIS AND INTERPRETATION OF COLOURS CHARACTERISTICS OF THE DYED SAMPLES, BASED ON REMISSION CURVES

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ABSTRACT. In this paper were analyzed and interpreted the colour characteristics of dyed samples, based on remission curves. The correlation between the remission dying and the dyes concentration, for wool dyeing with acid dyes was also studied.

There have been dying with two acid dyes on 100% wool fabric, six levels of concentration, ranging between 0,1% - 2,0%, in specific conditions of wool dyeing with acid dyes.

Remission curves were drawn for two dyes: red and yellow and mixtures of two dyes take in equal parts, in the visible spectral domain. Based on these remission curves, were analyzed and interpreted the following: the colour characteristics for dyed samples, the correlation between remission colour and the concentration of dyes and the interaction between the dyes in mixing pain.

Keywords: *remission, acid colorants, wool texture, visible spectral domain, dyeing, concentrations, colours characteristics.*

INTRODUCTION

Colour is a subjective phenomenon, a response of the brain at the stimulation of the eye with light. [1].

Perception of colour sensation varies widely limits from individual to individual, depending on age, environment in which observation is made, the level of lighting and other factors. These differences in the subjective assessment of corps colours, including textile materials, imposed the need to introduce methods of objective measurement and numerical assessment of visual sensation and of its size [1].

It was assign three characteristics to colour, as visual sensation: nuance, saturation and brightness [1].

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The colour nuance allows the eye to distinguish different components of white light (daylight): red, orange, green, blue etc. The colour nuance is given by the spectral position in the spectrum of wave length appropriate. The nuance of a certain colour is given by the position in the spectrum of white light of the dominant length of the wave. The nuance of a colours is a quality characteristic [1].

The saturation or purity excitation of a colour represents the amount of pure colour (spectral colour) contained in it, compared with an achromatic colour of the same luminosity (grey). Mixing with other wavelength or white light, colour spectrum undergoes a desaturation. Spectral colours are saturated colours, for which was adopted by convention the value equal to unity (s=1), and white saturation is zero. Colour saturation is a quantitative characteristic.[1]

Luminosity of a colour scale is related to sensation of bright that produces. Thus, the different colours appear to emit more or less light. Luminosity is the only characteristic of an achromatic colour and varies from the maximum value conventionally noted with 100 for white to 0 for black. Between these two marks are located grey colours characterized by intermediate values of luminosity [1].

Qualitative description of a colour is done with reference colours: white, black neutral greys and spectral colours. The colour's attributes are described to these guidelines: nuance, saturation, brightness and differences between two or more colours.

Assessing the surfaces colours areas (corps) that haven't their own light requires illumination with light emitted by an illuminator.

Colour is one of the most important attributes of a textile material. A wool sample is composed of several fibres. Fibres have curved surfaces and are oriented in different directions so that the reflection of light is diffused in all directions [2].

When incident light is on a dyed wool material is observed that a small amount of incident light are reflected by the external surface of the sample, and the largest quantity of incident light enters inside the material, where is reflected by the individual fibres in all directions, and then is reflected off the sample.

When incident light is on a non-dyed woollen material it will have the same colour with the reflected light. In daylight non-dyed wool the will be appreciated by the eye as more or less white.

If the material is dyed, a part of incident light is absorbed by molecules of the colorant. Since each colour absorbs light only in a certain region of wavelength, the composition of reflected light depends on the type and the concentration of the colour. In case of light colours, a small amount of light is absorbed, while the rest is reflected and in case of dark colours more light is absorbed and less reflected [2].

RESULTS AND DISCUSSION

For data processing was used Excel program, which provided facilities for database processing and enabled graphical formats as curves of remission [3,4].

The remission curves presented in Figures 1, 2 and 3 shows that:

For all dyeing obtained with Bemacid Gelb GR dye (figure 1) due to changes in concentrations of dyeing, the remission curves aspect is constant. Remissions amplitude decreases with increasing of concentration in dyeing, and with increasing of colour intensity [1,4, 5, 6].

For colour nuance study is made the following interpretation of the curves of remission: maximum remissions of studied colour are located in the spectral range of 580-700 nm. Given that the values of green remissions between 500-560 nm, offset remissions of red of the spectrum between 600-700 nm, because the colours of these two spectral domains are complementary, that blend studied dominant colour is yellow, the same wavelength for all colours. Dominant yellow tone, located in the 580-640 nm spectral colours for all represented, and is highlighted by the very low spectral remissions fields of purple and blue, for λ = 400-500 nm. The latter include complementary colours yellow colours.

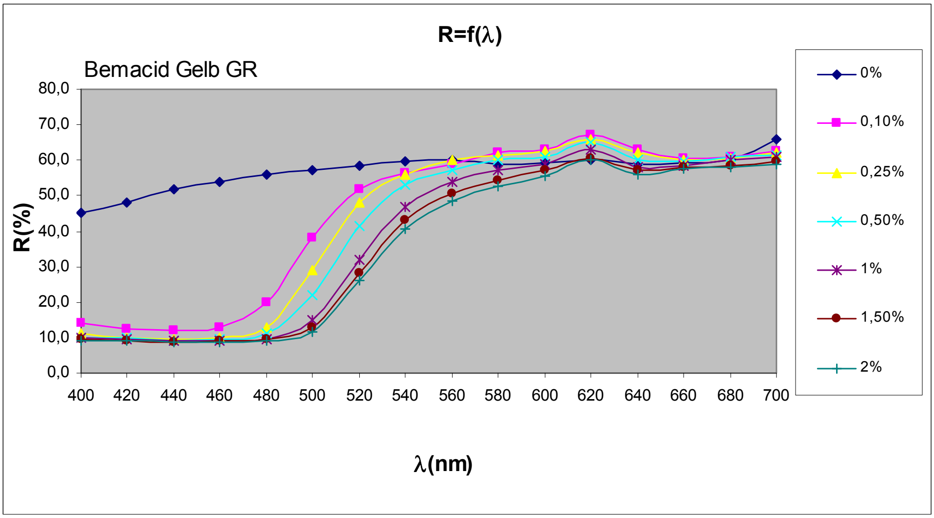

Figure 1. Remission curves of Bemacid Gelb GR

Absences of these colors in visible beam radiation reflected by colored surfaces allow yellow radiation to maintain preponderant. The brightness of studied color (sometimes called luster or clarity) can be expressed by the difference between the maximum of remission value and the value of remission of complementary color [1,3, 6]. Brightness values are between 55% (for the colors obtained with 0.1% dye) and 51.5% (for the colors obtained with 2% dye). It is noted a very little brightness decreases with increasing of dye concentration. As a result, the yellow colors not lose too much brightness, while increasing their intensity.

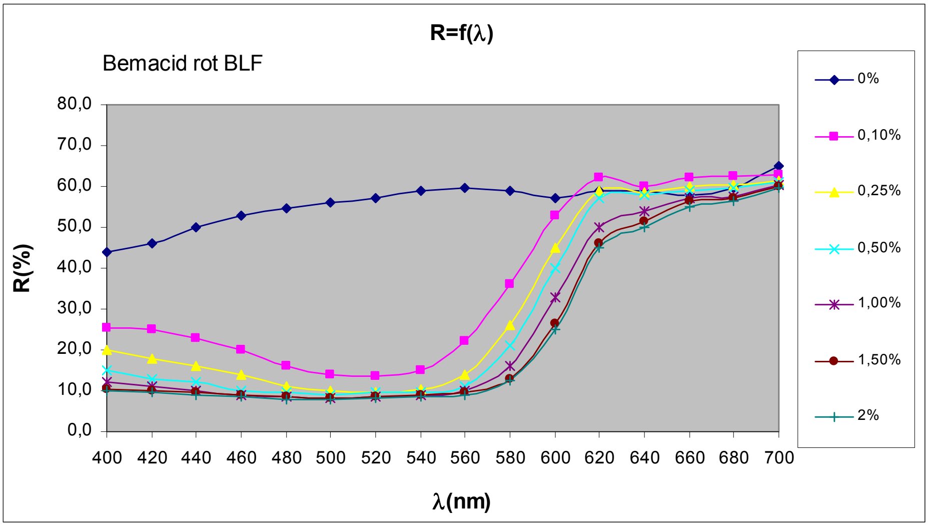

Figure 2. Curves of remission of Bemacid Rot BLF

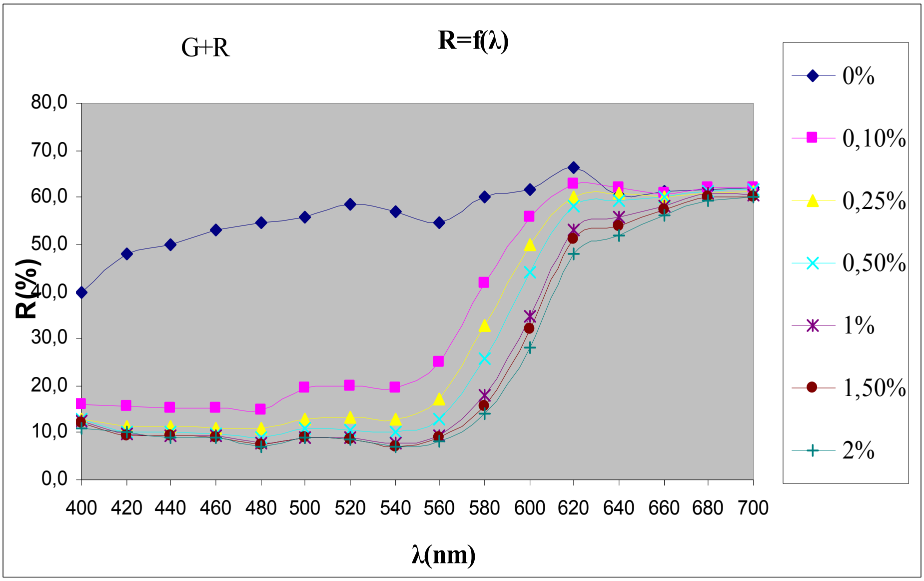

Figure 3. Remission curves of mixtures of Bemacid Gelb GR and Bemacid Rot BLF

For all dyeing with Bemacid Rot BLF dye (figure 2) as a result of changes of the dyeing concentrations, the remission curves remain constant. Remissions amplitude decreases with increasing concentration in dyeing, and with intensity of color increasing. Also found that for concentrations of 1.5% and 2%, the dyeing remissions were very close, the dyeing is very close each to other, although they were dyed with different dye concentrations. This is due to a possible low absorption capacity of colourant, capacity that decreases with increasing concentration so that remission in visible area has close values.

For colors nuance study is made the following interpretation of the curves of remission: maximum remission of studied dyeing are located in the spectral range of 600-700 nm. The maximum length of remissions corresponds to waveform of 700 nm. In the rest of visible spectral domain, remissions values are very low, making the brightness of measured samples to be located, due to radiation, only in a restricted area of the visible spectrum. Applying the method of calculating the color brightness by making the difference between maximum remission and minimum remission, the brightness values are between 49.5% (for dyeing with 0.1% dye) and 51.9% (for coating with 2% dye).

$R_{\lambda max} - R_{\lambda complementar} = 63 - 13.5 = 49.5\%$ (for dyeing with 0.1% dye)
$R_{\lambda max} - R_{\lambda complementar} = 59.8 - 7.9 = 51.9\%$ (for dyeing with 2% dye)

For the colors obtained with mixtures of dyes: Bemacid Gelb GR and Bemacid Rot BLF (figure 3) the curves of remission remain constant. For spectral domain between 420-560 nm, for concentrations higher than 0.5%, their remission values are very close or even equal, so that remission curves overlap in this field. Maximum remission color studied is located in orange, yellow and red between 595-605 nm, 580-595 nm and 605-640 nm. Dyed samples remit in the blue, blue-green, green-blue, green, yellow-green, red spectral domain between 440-540 nm, 540-580 nm, 605-640 nm.

Starting from these premises, to highlight the interaction between the two dyes are analyzed in terms of quality the remission curves for the two colors [1,6-9].

In Figures 4, 5, 6 are illustrated remission curves separately for the two individual dyes and their mixture at different concentrations.

Figure 4, figure 5, figure 6. shows that from a mixture of: 0.25% Bemacid Rot BLF and 0.25% Bemacid Gelb GR; 0.50%, Bemacid Rot BLF and 0.50% Bemacid Gelb GR; 1% Bemacid Rot BLF and 1% Bemacid Gelb GR is obtained orange dyeing. From standard dyeing with each color in hand is observed that in the red area of the spectrum, both colors absorbs very little. The orange color obtained from the yellow color and red color will have the same remission in red, with the two colors. In the field of green will only absorb the color red. The orange color obtained from red and yellow colors, will have the same remission in green, which presents the color red [1,9-11].

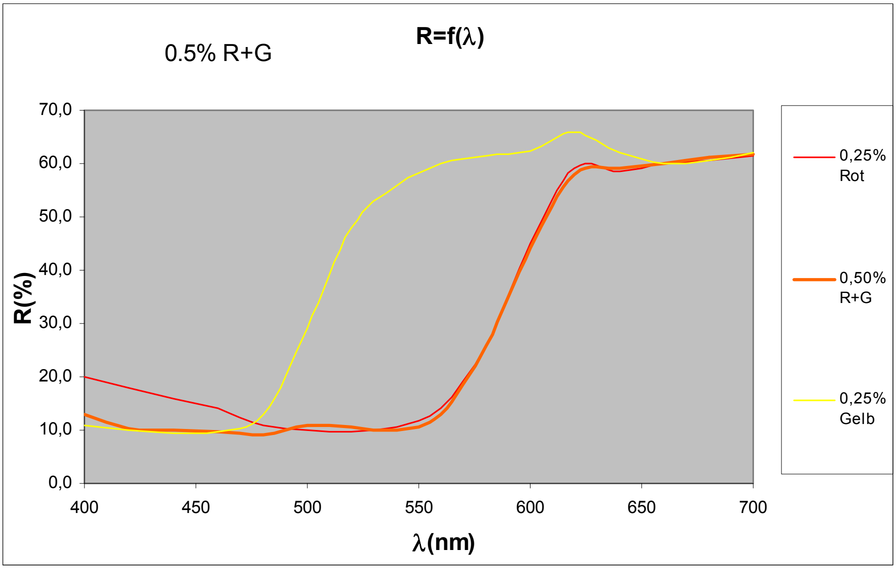

Figure 4. Remission curves for Bemacid Gelb GR, Bemacid Rot BLF and their mixture.

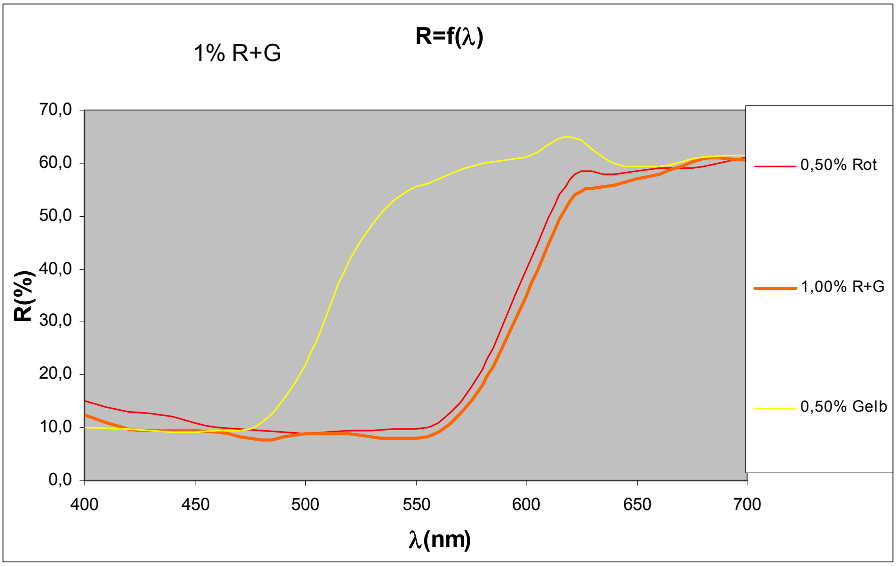

Figure 5. Remission curves for Bemacid Gelb GR, Bemacid Rot BLF and their mixture.

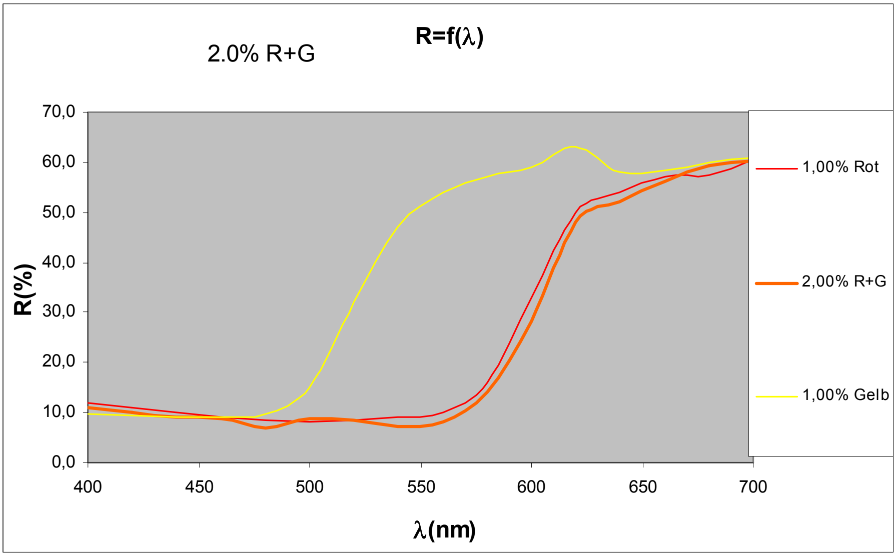

Figure 6. Remission curves for Bemacid Gelb GR, Bemacid Rot BLF and their mixture.

CONCLUSIONS

Remission curves drawn were allowed to discuss color characteristics of standard dyeing obtained with studied colors and the colors obtained by mixing the two dyes and the dependence on the concentration of dye color that was made.

Color shades are interpreted, especially on remission maxim presented on the analysed curves and their modification.

The differences that occur, due to mutual influence the ability of exhaustion of dyes in the bathroom, or a dependency of the ability of the exhaustion of dye bath in dyeing .

Between remissions dyeing with unitary dyes and remissions dyeing with mixed dyes there is interdependence. This interdependence puts in evidence the effect substractivites manifested by each color on the spectral composition of the other color.

EXPERIMENTAL SECTION

This paper presents the tinctorial characteristics of two acid dyes that will serve at preparing bath dyeing with calculated recipes. Studied dyes are acid dyes produced by Bezema, Switzerland: Bemacid Rot BLF and Bemacid Gelb GR. With these unitary dyes were made standard painting on 100% wool fabric at concentrations ranging from 0.1% to 2.0%, the specific conditions of wool dyeing with acid dyes. [1, 2, 3, 4,10, 11]. Dyeing colours obtained were measured on a Specol 10 spectrophotometer, at 16 wavelength of visible located at intervals of 20 nm. In parallel there have been dyeing on wool with mixtures of the two dyes taken in equal parts for the same range of concentrations used for unitary colours.

At present there are spectrophotometer and specialized software that allow the measurement, colorimetric data storage, calculating the coordinates of chromatic colour, intensity of colour, the chromatic parameters of colour and draws automatically the remission curves [12, 13].

REFERENCES

1. L.E. Puscas, D.C. Radu, “Introduction to knowledge and measurement of color”, Dosoftei Ed, Iasi, **1997**.
2. M. Pustianu, M.S. Bucur, *Magazine of chemistry*, **2005**, *7*, 746.
3. M. Pustianu, “Instrumental elaboration of optimized recipes dyeing samplesof 100% wool”-PhD Thesis, Technical University "Gh.Asachi" Iasi, **2000**.
4. M. Pustianu, *Textile industry magazine*, **2006**, *1*, 28.
5. R.H. Wardman, S. Farooq, K.J. Smith, *Coloration Technology*, **2012,** *128*, 3, 161.
6. A. Shams-Nateri, *Coloration Technology,* **2009**, 125, 1, 36.
7. L.E. Puscas, “Measurement and color theory”,Dosoftei Ed, Iasi, **1983**.
8. G. Wyozecki, SW Stiles, “Color science.Conceptesand methods. Quantitative data and formulas”, John Whiley & Sons, ed. II, **1982**.
9. Berger, A., Brockes, A., *Bayer Farben Revue*, No. 3 / 1.
10. ***”Catalog Bezema”, **1993**.
11. J.C. Guthrie, J. Moir, *Rev.Progr.Coloration*, **1978**, *9*, 1.
12. S. Komboonchoo, T. Bechtold, *Journal of Cleaner Production*, **2009,** *17*, 1487.
13. H. Ghouilaa, N. Meksib, W. Haddarb, M.F. Mhennib, H.B. Janneta, *Industrial Crops and Products,* **2012**, *35*, 31.