CONTRIBUTION TO AUTHENTICATION OF VICTOR BRAUNER ARTWORKS

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*S-a realizat analiza spectrală şi cromatică a patru picturi din perioada 1923 – 1928 semnate Victor Brauner, în scopul certificării autorului. In acest sens câteva probe de roşu şi roşu – brun şi pigmenţi standard din colecţia 1920 au fost analizate pe baza datelor experimentale oferite de spectrele UV – VIS – NIR, FTIR, AAS în strânsă corelaţie cu parametrii tristimulus în sistemul CIE – L*a*b*.*

*The spectral and chromatic analysis of four of Victor Brauner's artworks assigned to the period 1923 – 1928 is performed in relation to their authorship certification. In this respect, several red and red – brown samples and standard pigments from 1920 collection are comparatively discussed, based on experimental data provided by UV – VIS – NIR, FTIR, AAS spectra in tight connection with the tristimulus chromatic parameters obtained in CIE – L*a*b* system.*

Keywords: spectral analysis, chromatic analysis, artworks, pigments, Victor Brauner

1. Introduction

The first artistic trials performed by Victor Brauner in his beginning period of creation, let their fingerprints on his style for the entire creation. Recently, these roots are under careful investigation in order to establish some decisive features for the authorship certification in some of his artworks.

Previous investigations revealed the author's preference for using various green tones in his colouristic palette [1, 2].

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The aim of this paper is focused on spectral and chromatic analysis by instrumental methods: UV-VIS-NIR, FT-IR, AAS of some red and red-brown samples taken from several of Victor Brauner's works painted between 1923 – 1928.

2. Experimental

Materials

In order to perform the spectral analysis, samples from Victor Brauner's artworks belonging to the Art Museum of Tulcea have been collected according to the regulation procedures in the field. The investigated pictures were:

427 – The old lady between two girls
429 – The chevalier/The workwoman
430 – The boy with the pitcher
612 – Woman portrait

For the chromophore assessment a number of pigments considered as standards have been also investigated.

For IR analysis the samples were embedded into spectral KBr (Merck). For UV – VIS – NIR analysis the samples were mixed with MgO (Merck).

The solid samples were digested using the wet technique by heating with HNO_3 65% (Merck) and H_2O_2 30% (Merck).

Devices

The spectral analyses have been performed using the following devices:

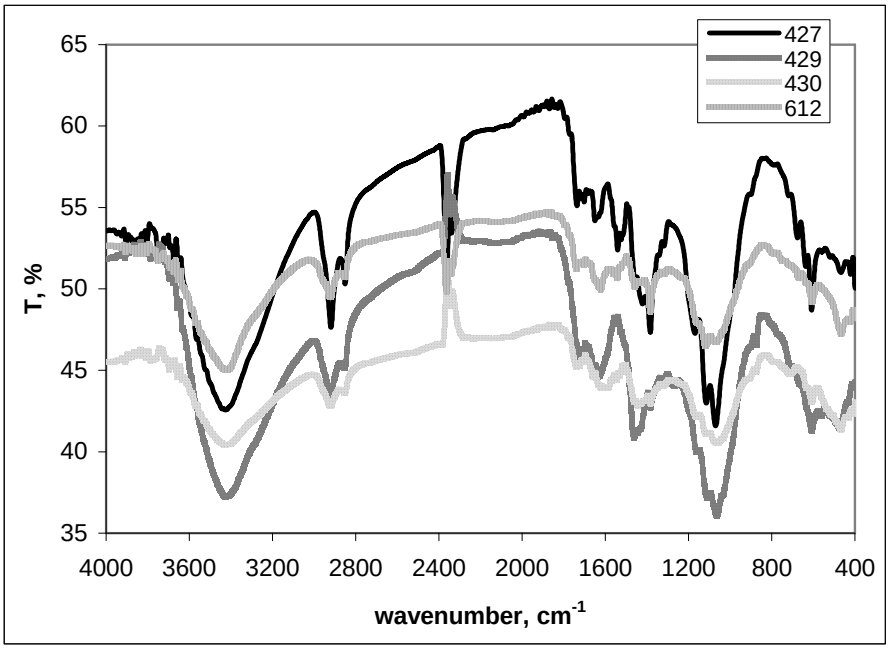
- FTIR – 620 Spectrometer, Jasco, Japan,
- Spectrometer V 570, Jasco, Japan with difuse reflectance (ILN 472),
- Atomic Absorption Spectrometer AAS – Vario 6, Analytik Jena.

The colour characteristics have been determined by CIE – L*a*b* spatial chromatic system.

3. Results and discussion

In order to assign Victor Brauner's artworks, several spectral analyses have been mainly used [3]. A visual observation on the Victor Brauner's paintings revealed that the painter used especially the following colours: green, red, blue and yellow either individually or in a mixture.

Since previous papers [1, 2] have been devoted to green colour, this paper is focused on red and brown tones.



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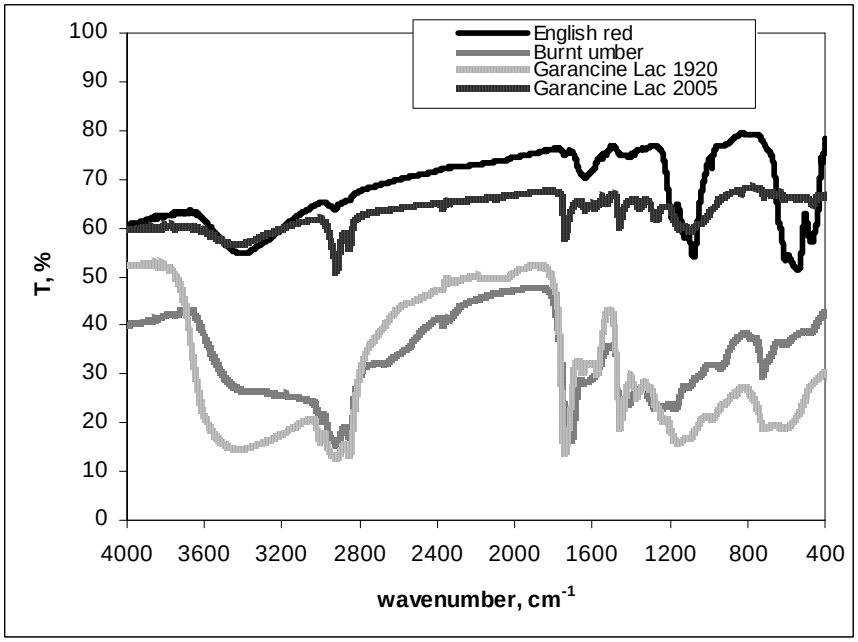

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Fig. 1. IR spectra of the samples (a) and standard pigments and varnishes (b)

IR spectral characterization

Figs. 1a and 1b and Table 1 reveal that the samples have characteristic bands at quite similar wavelengths, the shifts being small [4].

It can be noticed the dominant composition in mineral oil by means of characteristic bands at 2850 – 2920 cm^{-1} assessed to CH_2 vibrations, together with bands at 3430 and 1720 cm^{-1} specific to – COOH group.

Table 1.

IR Characteristic Bands ν, cm^{-1}

427	429	430	612	Garancine Lac (1920)	Garancine Lac (2005)	English Red	Burnt umber	Assessment
3425	3424	3429	3472	3423	3448	3410	3402	ν-OH
2913	2919	2922	2922	2925	2925	2926	2929	ν-CH_2 asymmetric
2844	2849	2855	2849	2854	2854	-	2849	ν-CH_2 symetric
1714	1739	1734	1724	1745	1745	-	1738	δ-CH aromatic
1629	1644 1545	1609	1630	1650	1650	1630	-	ν-C=O
1462	-	1445	1455	1462	1463	-	1460	$ν_4$ CO_3 (carbonatation) or δ-CH_2
	1390	1381	1384	1376	1360	-	1375	δ-CH_3
1109 1061	1171 1117 1071 } triplet	1115	1118	1114	1145	1187 1122	1179	ν-Si – O – Si $ν_3$ SO_4 ν-C – $C_{skeleton}$ ν-C – O alifatic
-	-	1057	1057	1097	1097	1078 983	942	ν-Si – O or $ν_3$ SO_4
-	-	714		713	719	-	723	ν-$(CH_2)_{n \geq 4}$
604	679 638 604	604	671 607	615	671 615	602	599	$ν_4$ SO_4
468	470	470	464	-	-	474 413	474	ν-M - O

The pigment identification was carried out using the bands ranging between 500 – 1200 cm^{-1} as reference. These bands were compared to those of the standards (Table 1). The comparison shows that Victor Brauner used as main red

pigment *English – red*, working probably also with *Garancine varnish* (1920) and *Burnt umber*.

The mineral contribution can be assigned due to the band at 1070 – 1190 cm^{-1}, specific for Si – O – Si and Si – O vibrations.

This assessment is supported by the presence in all samples of the bands characteristic to SO_4^{2-} at 1115, 1136, 1144 (ν_3) and 618, 622, 672 (ν_4), and also in the English red pigment.

The bands below 600 cm^{-1} belong to the M – O vibrations. Among these the presence of the iron and manganese oxides is also confirmed by the elemental analysis as it is shown below.

Spectral Absorption Analysis

The spectral absorption analysis shows the main metals present in two of the samples (Table 2) in comparison with standards pigments. It can be seen that iron and manganese are present in both samples, confirming thus the use of brown pigment similar to Burnt umber.

The high level of zinc content in the sample 430 can be explained by the use of zinc oxide or sulphate as diluter, the tones in "The boy with the pitcher"(430) being very light, and by the presence of the support as well.

Table 2.

Metal content of samples and standards

Sample	Metal, (mg/g)			
	Fe	**Cu**	**Mn**	**Zn**
429	7.35	0.12	0.11	4.78
430	6.68	0.18	0.52	121.85
Garancine Lac (1920)	0.92	-	-	-
Burnt umber	13.77	-	0.23	-

UV-VIS-NIR Analysis

The intensive and wide absorbance band at 320 – 580 nm is characteristic to the colour (Fig. 2a and 2b). The bands in NIR domain at 1485, 1937 and 2080 cm^{-1} are specific to the combination bands of SO_4^{2-} group, thus confirming the use of English red type pigment. The small band at 870 cm^{-1} also support the presence of the iron oxide from both red and brown pigments.

The UV – VIS spectra have been used in order to determine the chromatic characteristics (Table 3) in CIE L*a*b* system [5, 6].

Table 3.

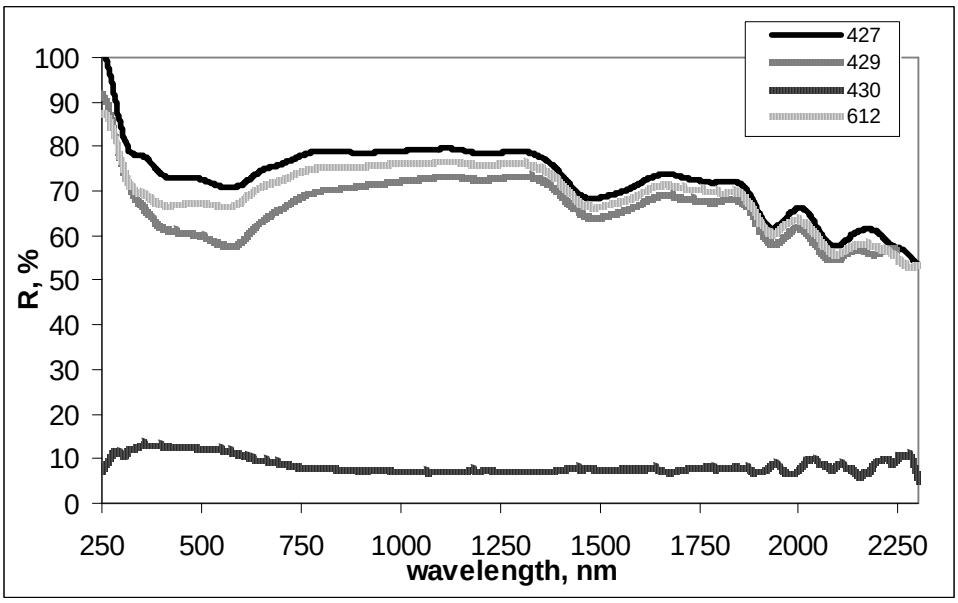
Chromatic Characteristics of samples and standards

Sample	**L^***	**a^***	**b^***	**C^***	**$H_{ab}°$**
427	22.68	- 5.64	- 10.58	12.00	61.94
429	47.64	3.49	3.43	4.91	44.51
430	13.69	10.66	8.25	13.40	37.74
612	33.96	4.46	11.62	12.44	68.80
Garancine Lac (1920)	77.91	9.89	0.82	9.93	4.76
Garancine Lac (2005)	38.19	12.30	2.28	12.51	10.52
English Red	36.67	27.42	19.37	33.57	35.24
Burnt umber	54.70	-0.12	0.74	0.69	92.32

Except for the sample 427, all the other three samples exhibit chromatic characteristic specific to red colour ($a^* > 0$ - red, $b^* > 0$ – yellow) in various proportions as is quantified by the hue angle $H_{ab}° = 44.51$, with similar weights in 429 sample, 37.34 dominant red in 430 sample, and 68.80, dominant yellow in 612 sample.

The standard pigment, English red is obviously dominant in red tone ($H_{ab}° = 35.24$).

In the sample 427, the negative values for tristimulus parameters: $a^* = – 5.64$ (green) and $b^* = – 10.58$ (blue) are due to the very dark tone, brown toward black, this colour being obtained by mixing various pigments of many tones. The brown pigment can have a contribution to green tone $a^* < 0$, while for $b^* < 0$ another blue pigment was used by the artist. This dark colour is also confirmed by the lowest value of luminosity ($L^* = 22.68$) when comparing to all the other samples and standard pigments.



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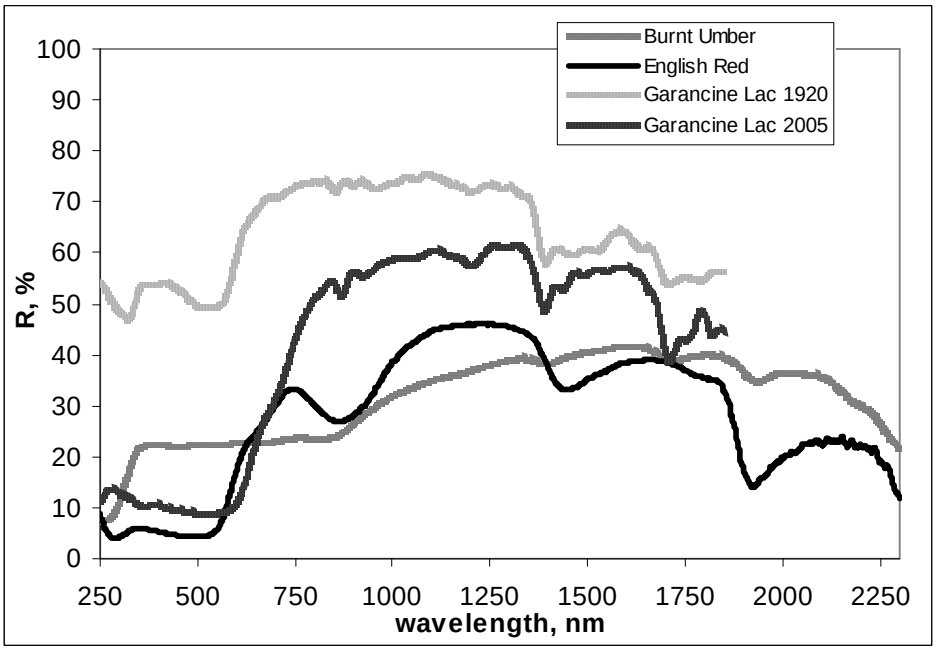

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Fig. 2. UV VIS spectra for the samples (a), and standard pigments and varnishes (b)

4. Conclusion

The spectral analysis of some red and red – brown samples taken from four of Victor Brauner's works revealed the use of the English red and Burnt umber type pigments. The presence of iron and manganese as main chromophores was demonstrated by the d –d transition band in NIR domain, M – O bands in IRspectra and also by elemental analysis.

The assessment of English red type pigment as the main component of the pictural mixture is supported by SO_4^{2-} bands both in IR and NIR domains. The contribution of these two pigments (red and brown) in the analysed samples is also discussed on the basis of chromatic parameters in CIE – L*a*b* system.

R E F E R E N C E S

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