

Scientific Investigation of the Saint Elijah's Icon from Dragus Village, Brasov County for its Preservation and Restoration

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The Saint Elijah's glass icon was investigated by FTIR and mass spectrometry methods for identifying the painting materials in order to preserve and restore it. The glass icon was realized in fatty tempera with egg yolk and vegetal oil was used as binder. The painting materials are as follows: red (lead minium), blue (Prussian blue), green (Prussian blue+ massicot), white (ZnO and lead white), yellow (massicot lead yellow, PbO), gypsum and Ca carbonate as color diluents.

Keywords: glass icons, painting materials, FTIR spectroscopy, mass spectrometry

The Saint Prophet Elijah is one of the Old Testament's themes that are frequently represented in the Christian iconography: he is the one that received the power over nature, to open and close the skies, reason for which he is worshiped mostly by farmers. With the power of prier he has descended fire from the sky and was raised alive to the sky in a chariot of fire [1].

In Transylvania, Saint Elijah's icon with the chariot of fire is a very popular representation, because he was one of the patrons for rural life [2].

The icon from figure 1 presents Prophet Elijah in two distinct registers.



Fig. 1. "Saint Elijah" glass icon from the Cluj-Napoca Ethnographic Museum of Transylvania patrimony

The first register is the one regarding the lift, the ascension to the sky in the chariot of fire. This chariot is visually portrayal, by the painter, in the form of a traditional Transylvanian carriage, of Romanian roots, pulled by two red horses. Saint Elijah is represented standing and leading the horses.

The second registry represents Saint Elijah holding the strings of the sky, as a symbol of the power he has over rain and drought. The two registers are divided by the representation of the clouds, as a separation factor for the two spaces.

In the upper plan, the angels come to greet Saint Elijah, as a reward for the righteous life he has led.

In the lower plan there is Adam who is working the land with a plough pulled by two oxen, representing the connection between the farmer and Saint Elijah. The plough pulled by the two oxen is represented under the chariot pulled by the horses of fire. Both the horses and the oxen are represented climbing, in a symmetrical manner, the action of the plough being similar to the one belonging to the chariot of fire. The drawing is unskillful, but suggestive, the composition is simplified to the extreme and the colors are rough, but catchy [3].

The pallet of colors used is varied. Predominant are the colors of red and blue as symbol of royalty. The colors green, yellow, orange and white can also be found.

This icon is part of the heritage for the Ethnographic Museum of Transylvania; it comes from Drăgus village, Brasov County, and was painted in the XIXth century. It is part of the creation center for glass icons in Făgăras and Olt Country.

Several papers [4-30] were dedicated to the scientific investigation of some religious art objects like. The aim of this paper was to investigate the glass icon painting materials in order to preserve and restore them.

Experimental part

The modern analytical techniques used are FTIR and Mass spectrometry.

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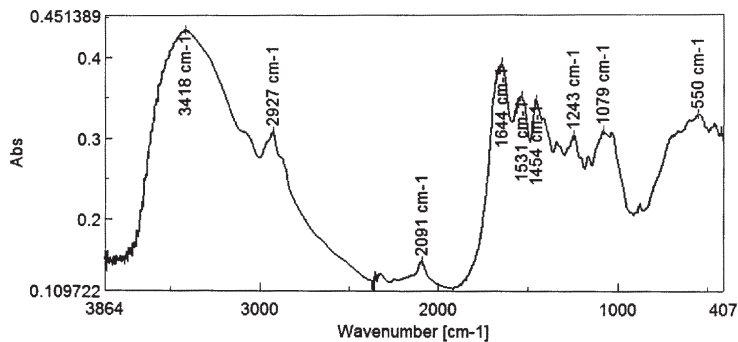


Fig. 2. FTIR spectrum of blue painting material
Composition: Prussian blue, gypsum, egg yolk

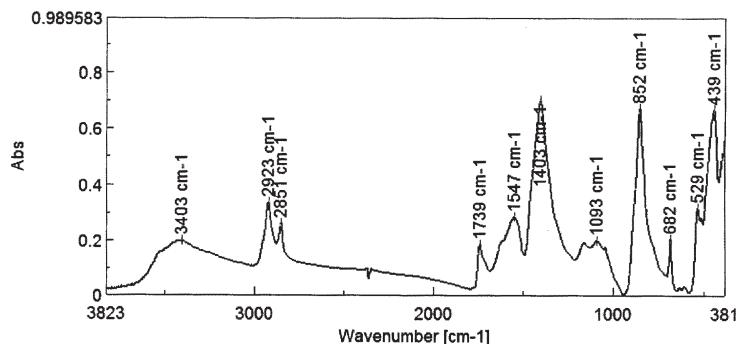


Fig. 3. FTIR spectrum of red painting material
Composition: lead minium, lead carbonate, egg yolk, gypsum traces

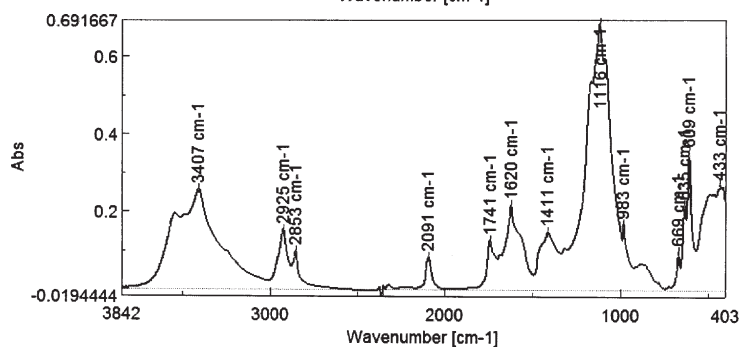


Fig. 4. FTIR spectrum of green painting material
Composition: gypsum, Prussian blue, massicot, egg yolk

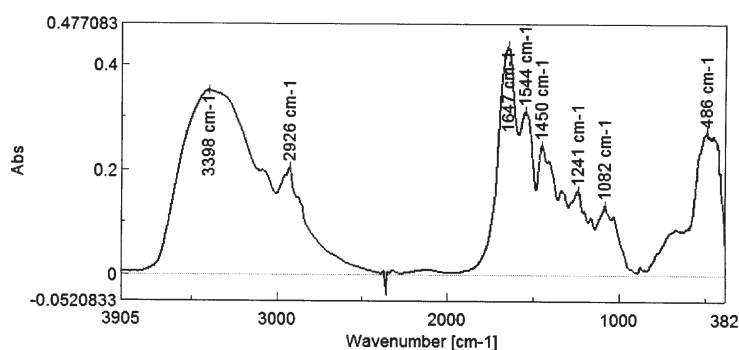


Fig. 5. FTIR spectrum of white painting material
Composition: ZnO, lead carbonate, egg yolk

FTIR spectra were recorded in the 4000 to 400 cm^{-1} spectral range with a resolution of 4 cm^{-1} with JASCO 6100 FTIR spectrometer by employing KBr pellet technique; the spectra were processed with Spectral Analysis software.

Mass spectra were obtained by Electron impact to energy of 70 eV, using a mass spectrometer Varian Mat, model 311. The sample was introduced by Direct Introduction System without derivatization. The sample was heated in the range of 25-300°C and the mass spectra were registered in full scan mode in the range 28-500 Daltons.

Results and discussions

FTIR spectroscopy

FTIR spectra of different painting materials are presented in figures 2-8.

Composition: aliphatics, gypsum and egg yolk traces.

Based on FTIR spectra analysis one can identify the following employed painting materials: red (lead minium, lead white, egg yolk, gypsum traces), blue (Prussian blue –

discovered and reported as blue pigment after the year 1730, egg yolk), green (Prussian blue, massicot, ZnO), white (ZnO, lead white, egg yolk), yellow (yellow lead-massicot, gypsum, lead carbonate, egg yolk).

In the analysis of the gold leaf and others pigments of old glass paintings, the FTIR data was compared with the one from other research on different icons [11, 12, 18-30].

Mass spectrometry

The mass spectra characteristic of the sample collected from icon lead to conclusion that picture base consist from oil of loxanol type containing mixture of fatty alcohols with number of carbons in range 8-18 and have a vegetal origin. The characteristic ion is $[\text{M}-46]^+$ produced by elimination of the neutral group $\text{C}_3\text{H}_6\text{O}$ ($\text{CH}_3\text{CH}_2\text{OH}$) from molecular ion by a rearrangement process [31]. The fragmentation reaction is:



Table 1
NUMBER OF C ATOMS, MOLECULAR MASS AND
CHARACTERISTIC ION [M-46]⁺ FOR FATTY ALCOHOLS

Nr. of C atoms	Molecular mass	m/z=[M-46]
C ₈	130	84
C ₉	144	98
C ₁₀	158	112
C ₁₁	172	126
C ₁₂	186	140
C ₁₃	200	154
C ₁₄	214	168
C ₁₅	228	182
C ₁₆	242	196
C ₁₇	256	210
C ₁₈	270	224

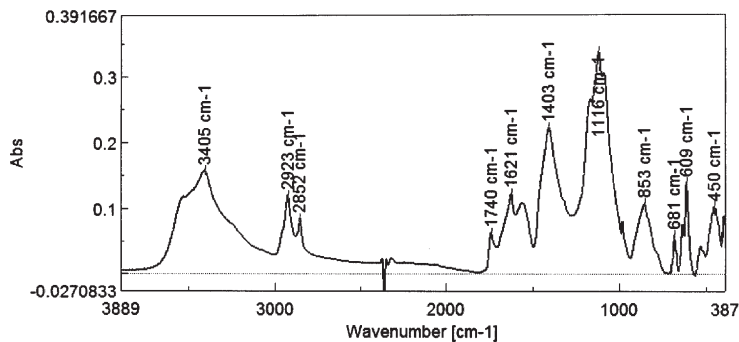


Fig. 6. FTIR spectrum of yellow painting material Composition: massicot, gypsum, lead carbonate, egg yolk

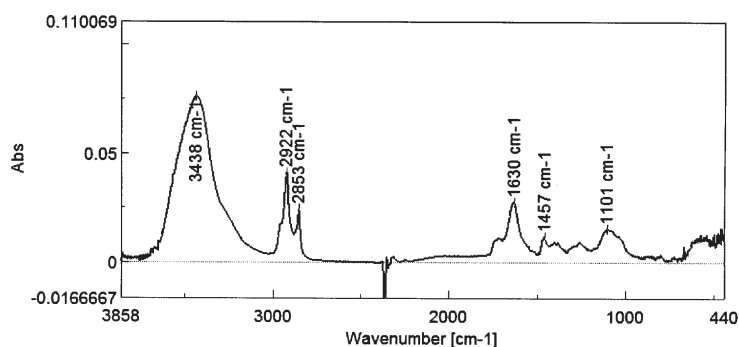


Fig. 7. FTIR spectrum of gold foil material
Composition: aliphatics, gypsum and egg yolk traces

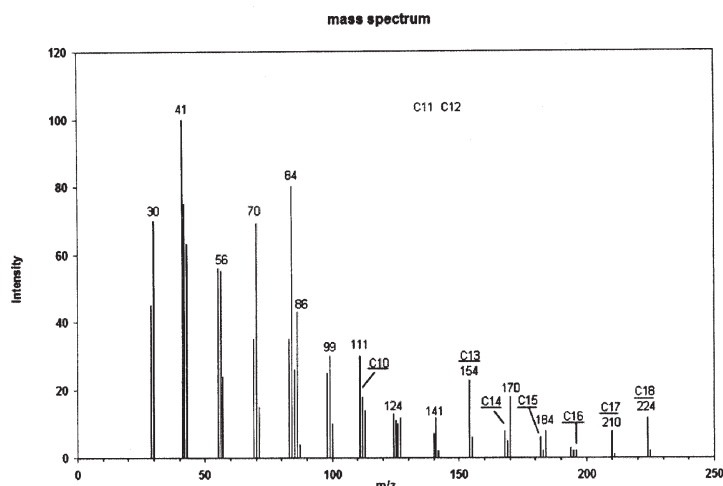


Fig. 8. The representative mass spectrum of the sample collected from icon.

In table 1 are shown some characteristic data of fatty alcohols mass spectra.

A representative mass spectrum of the sample collected from studied icon is shown in figure 8.

The representative mass spectrum of the sample collected from studied icon lead to conclusion that the picture material is based on oil of type loxanol (alcophor) containing fatty alcohols in the range C₈ – C₁₈. The origin of this oil can be vegetable or beeswax. Some recent papers reported bees wax as a source of poly alcohol oil [32] and scarce in fatty acids. The poly alcohol oil (loxanol) is recognized as being a very good tool in pigment dispersion [33, 34].

Conclusions

The “Saint Elijah” glass icon employed was realized in fatty tempera with egg yolk and vegetal oil used as binder. The painting materials are as follows: red (lead minium), blue (Prussian blue), green (Prussian blue+ massicot), white (ZnO and lead white), yellow (massicot lead yellow, PbO), gypsum and Pb carbonate as color diluents.

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