

Analytical Chemistry and Mass Spectrometry in Art

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Analytical chemistry offers many tools and approaches to investigate cultural heritage objects. It belongs to disciplines contributing to the study, care, and conservation of these valuable witnesses of our history. Since the first dated studies in the 18th century, analytical chemistry has reached the expansion period characterized, e.g., by portable instruments enabling noninvasive analyses *in situ*, the application of modern sophisticated techniques providing high sensitivity and selectivity minimizing the required sample's amount.¹ Although, noninvasive approaches are preferred, to obtain some information, microinvasive sampling followed by nondestructive or even destructive analysis is needed.

In the presentation, a few selected examples demonstrate results of microinvasive analyses to think about their usefulness. Optical and electron microscopy provide details on a painting cross section. Electron microscopy and energy-dispersive X-ray spectroscopy show the distribution of elements in a cross sections' layers which can contribute, e.g., to identifying pigments. Raman and infrared spectrometry represent optical and spectral methods. Raman spectra can reveal the presence of pigments in individual layers as demonstrated by analyzing the painted canvas. Pyrolysis-gas chromatography-mass spectrometry identified used varnish, binder, and glue.² Mass spectrometry is a very useful tool in analytical chemistry. Analyzing the artworks, it can identify plant gums³ (binders, varnishes, glues in general), confirm pigments.⁴ Mass spectrometry imaging can be performed by different approaches. Laser ablation-inductively coupled plasma mass spectrometry enables the elemental profiling of metals⁵ and paintings.⁶ Time-of-flight secondary ion mass spectrometry provides information on inorganic (pigments) as well as organic (binders) components of painting cross sections.⁷ Desorption electrospray mass spectrometry images oil binders' distribution.^{8,9} To select a proper analytical method, we have to consider its properties like selectivity, sensitivity, etc. However, its invasiveness to artworks is crucial for the decision about its application. This decision must be achieved in the interaction of specialists representing different disciplines (art historians, conservation scientists, chemists, conservators, etc.).

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