

The investigation of artwork pollution by chromato-mass spectrometry

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Keywords: gas chromatography, mass spectrometry, identification, museum exhibits, marble bas-relief, majolica, beeswax.

Abstract

This publication is the result of one of the first studies conducted by the staff of the National Research Center «Kurchatov Institute» on the basis of artworks stored in the funds of The Pushkin State Museum of Fine Arts. At the first stage of the fundamental restoration of sculpture exhibits, it is necessary to conduct surfaces state complex investigations and to accurately identify the composition of the contaminants and materials used as protective coatings. To this aim, at the first stage, the possibilities of a number of solvents for extracting organic contaminants from the surfaces of the exhibits prepared for restoration and determination of their composition were investigated.

The following solvents were used in the work: methanol, ethanol, propanol-2, acetone, chloroform, hexane, cyclohexane, methylene chloride, acetonitrile. The applicability of solvent to remove contaminants from the artifact surface was estimated visually by the coloration degree of the cotton swab wetted with a solvent. The best results for extraction of organic contaminants were obtained by using a multicomponent solvent mixture: propanol-2, cyclohexane, methylene chloride, acetonitrile.

Two museum exhibits from the collections of The Pushkin State Museum of Fine Arts: "Flagellation of Christ" (marble bas-relief) and "Madonna and Child with Hands" (majolica) were provided to research. The washings of organic contaminants from the surface of the investigated exhibits were studied by gas chromatography and mass spectrometry, resulted in the identification of more than 20 organic compounds of various classes: fatty alcohols, fatty acids and esters. By analysis of washings from the surface of both exhibits was showed that they have identical contaminant compositions, which are caused by condensation on their surface of pyrolysis products formed as a result of a fire in the storage room. The most suitable solvent system for flushing organic contaminants during the restoration process was proposed.

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