Determination and source identification of organic acids in the preservation environment of cultural relics

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Abstract Organic acids are common pollutants in the display and preservation environment of cultural relics, which can cause corrosion of artworks and affect the safety of artworks. Recently, blue crystalline substances were found on the surface of some enamel wares on display and white crystals were found on some bricks in storage in the museum. Therefore, in this study, organic acids in the preservation environment were determined by different methods, and the source of these compounds were identified. The air inside the showcase, wooden cabinet, and ambient with large spaces was sampled by the absorption solution of ultrapure water and analyzed by Ion Chromatography (IC). Gas detector tubes were also used to rapidly determine the acetic acid concentrations. Pollutants in packaging boxes with small spaces were enriched by solid-phase micro-extraction arrow and analyzed by Gas Chromatography-Mass Spectrometry (GC/MS). The results show that concentrations of acetic acid in showcases and cabinets are much higher than that in the ambient air. Meanwhile, acetic acid concentrations increase when putting exhibition appliances in showcases. The GC/MS analysis results show that several kinds of carboxylic acids are identified inside the packaging boxes, including acetic acid, pentanoic acid, and hexanoic acid, which are not found in their preservation ambient air. These results indicate that the corrosion of enamel wares and bricks is mainly caused by the organic acids emitted from exhibition and preservation materials. Moreover, the results of gas detector tubes are consistent with that of IC, which means that gas detector tubes can be used to determine the concentration levels of acetic acid in some specific situations. This study clarifies the determination methods of organic acids in different preservation environments. The sources of pollutants are also identified, which provides a reference for the preventive conservation of cultural relics during exhibition and preservation.

Keywords Organic acids, preservation environment, source identification, IC, GC/MS

Reference

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