The Potential Problems of AESUB Sublimating Scanning Sprays for 3D Scanning in Conservation

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Abstract

There is an interest in using 3D scanning techniques in the field of conservation and restoration (Acke et al. 2021). Many are already using these techniques for digitization and research purposes, or 3D reproductions of objects (Acke et al. 2021). 3D scanning does have some challenges when it comes to objects with shiny, transparent, or dark surfaces (McMillion 2022, Motley 2021, Mubanga 2022). Hair, fur and feathers may be difficult to scan (McMillion 2022), as well as bones and teeth, according to the experience of the authors. There are various methods to help overcome this challenge, one being scanning sprays (McMillion 2022, Motley 2021). AESUB sublimating scanning sprays (produced by the AESUB company, hereafter "AESUB-spray") are used to make the surfaces more opaque, and like similar sprays, they are useful tools when dealing with challenging surfaces (McMillion 2022, Motley 2021). Their ability to disappear on their own makes them especially useful when working with objects, as cleaning becomes unnecessary (Christova 2020, Rowe and Rozeik 2008, Weththimuni and Licchelli 2023). But do the AESUB-sprays disappear completely, as implied by the manufacturer (AESUB 2023) or does something remain on the surface of objects once the matting effect has subsided?

In this study we tested three types of AESUB-sprays: AESUB Blue, AESUB Transparent and AESUB Yellow. These were chosen because their chemical composition was representative of the compounds found in the six sublimating scanning sprays that AESUB has produced, while being significantly different from one another in their specific chemical composition.

One test involved a continuous application AESUB-spray on small glass samples, as seen in Fig. 1. All samples were partially covered by aluminum foil before spray was applied. The foil was removed after the final application. The test clearly indicated that all three sprays left residue on the surface of the samples, as seen when comparing the control sample (1.A) to the treated samples (1.B-1.D). It appears that the residue

accumulates with continued application of AESUB-spray, and preliminary tests suggest that the residue will remain for several months.

The residues that accumulated on the surface of the glass samples shown in Fig. 1 were collected and examined with FTIR (Fourier-Transform Infrared Spectroscopy), specifically with an UATR-accessory (Universal Attenuated Total Reflectance) and with transmission spectroscopy where the residue was mixed with KBr (potassium bromide). The spectra produced generally indicate the presence of hydrocarbons, but more testing is required to identify the specific compostition. However, the bottom spectrum shown in Fig. 2, where the residue of AESUB Yellow was examined with FTIR UATR, may indicate the presence of carboxylic acid.

The exact contents of the residue, if such residues are left by other scanning sprays, or how the residue can potentially affect objects in the long term, has yet to be determined. The potential presence of carboxylic acid in the residue of AESUB Yellow can have a degrading effect on a variety of materials such as metals, glass and organic materials. Depending on the composition of the residue from AESUB-sprays, or similar sprays, there could be other compounds that could contribute to the degradation of objects. It is therefore important that we take a closer look at these types of sprays, and that we keep these residues and their potential risks in mind, if or when we apply these types of sprays to objects.

Keywords

FTIR, UATR, ATR, KBr, AESUB Blue, AESUB Transparent, AESUB Yellow, microscopy

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Conflicts of interest

The authors have declared that no competing interests exist.

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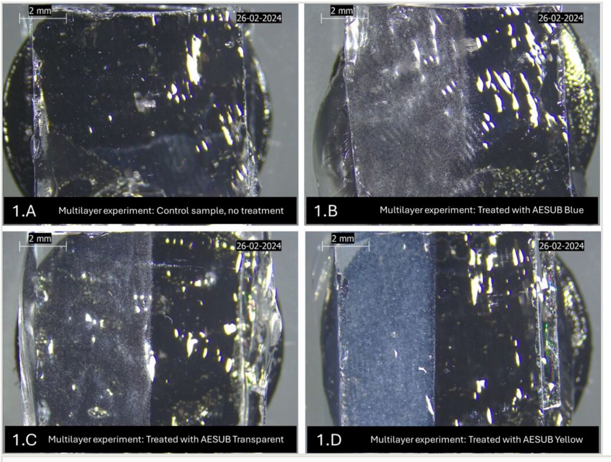

Figure 1.

1.A (upper left): Control sample, was not treated with AESUB-spray. 1.B (upper right): Sample treated with AESUB Blue. 1.C (lower left): Sample treated with AESUB Transparent. 1.D (lower right): Sample treated with AESUB Yellow.

All samples were partially covered by aluminum foil. 1.B-1.D were treated with approx. 84 layers of AESUB-spray. One layer is defined as one horizontal and one vertical zig-zag movement with up to 5 strokes in each direction. A clear visual divide can be seen between the treated areas (left sides) and the untreated areas (right sides) on the treated samples.

The images were adjusted for the purposes of this abstract, by translating the text from Danish to English. Credit: Nielsen (2024).

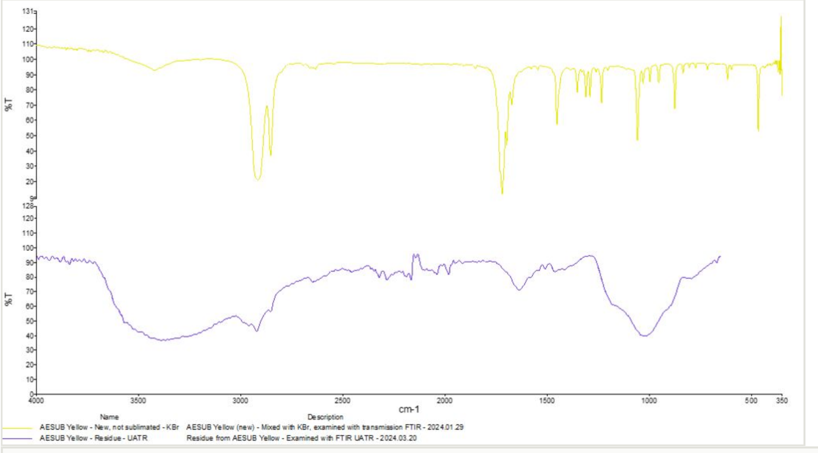

Figure 2.

The top spectrum (yellow) shows new AESUB Yellow, examined via transmission spectroscopy in the form of a KBr pellet. AESUB Yellow was examined shortly after it was taken from the original bottle. In this figure, the top spectrum (yellow) is used as a reference. The bottom spectrum (purple) shows the residue of AESUB Yellow, examined with FTIR UATR. The bottom spectrum was adjusted with the help of a "ATR Correction" function, so the two spectra can more easily be compared.

On the two spectra, especially the bottom spectrum (purple), there are peaks that may indicate the presence of carboxylic acid: A wide peak at over 3000 cm^{-1} (O-H), a peak between 1800-1630 cm^{-1} (C=O) and a peak around (or near) 1300-1000 cm^{-1} (C-O) (Gupta et al. 2023, Pavia et al. 2015).

The spectra was made using the raw data from Nielsen 2024, and were adjusted for the purposes of this abstract, by translating the text from Danish to English and changing the colors of the spectra.