

Abstract

Evaluation of PVA-Based Cryogels in the Cleaning Process of Contemporary Acrylic Paintings [†]

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Introduction: History can be defined as the study of people who have lived in the past. From one generation to another, people transmit values and knowledge through art. The more efficient the processes of evaluation, cleaning, and restoration of cultural heritage, the more efficient the communication between generations. Over time, the painting undergoes numerous oxidation processes by exposure to light or various contaminants from the environment which causes loss of visibility through the formation of unwanted layers [1,2]. Today’s study aims to evaluate some recipes for cryogels in the process of cleaning acrylic paints. **Materials and methods:** Sample preparation consisted of application of pigments in two steps on a black paper with thickness 0.2 mm, using ordinary brushes. Aging process was simulated when the paintings samples was introduced at climate chamber KK150 for 3 days at $T = 50\text{ }^{\circ}\text{C}$ and $\text{RH} = 15\%$ with 4 h/day. An artificial soil with the composition described in [3] was applied on the paintings in order to partially simulate the natural soiling of the paintings exposed to pollutants, dust, or smoke. For cryogel synthesis, we used 10 g polyvinyl alcohol (PVA) dissolved in 100 mL H_2O through magnetic stirring for 2 h at 800 rpm and $85\text{ }^{\circ}\text{C}$. After this step, the content was transferred in a Petri dish and kept at room temperature to cool. The subsequent freezing–thawing cycles consisted in placing the samples on the freezer for 20 h at a temperature of $-20\text{ }^{\circ}\text{C}$ then thaw for 4 h at room temperature [4]. For the removal of the hydrophobic layer, a microemulsion O/W based on toluene, water, Triton X-100, and n-butanol was used. The microemulsion can be uploaded in cryogel in two ways; before starting the first FT cycle or through immersion in microemulsion for 24 h after the last FT cycle. **Results:** To remove the excess of microemulsion, the gel is placed for a few minutes in a sheet of filter paper. The gel was applied to the substrate with tweezers, every 2 min, when the position of gel was changed. Color analysis was made with a chromameter Konica Minolta CR-410 and with a hyperspectral camera GreenEye Vis-NIR in the initial state, after the soiling process, after the application of the first stage of treatment, and, respectively after the second treatment. The differences of the values between the chromatic parameters of the initial and the final state must be as small as possible. **Conclusions:** The layer of dirt was removed and the acrylic pigment was not absorbed by cryogel (Figure 1). The evaluation of cleaning capacity was quantified through optical microscopy, colorimetry, and imaging spectral data.

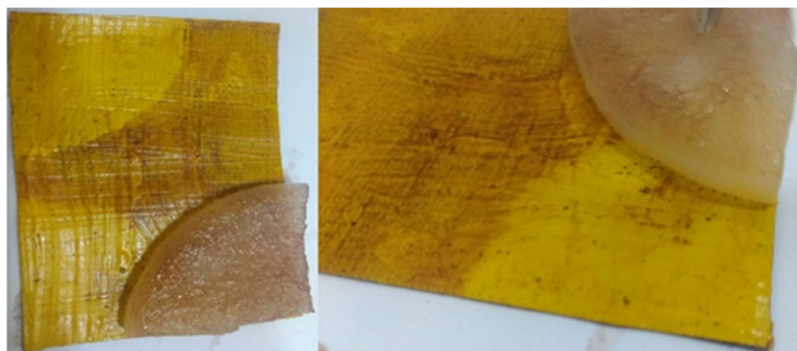


Figure 1. The application of first treatment.

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