

TECHNICAL DATA SHEET

2090 004 | Nanorestore Cleaning®, Polar Coating G

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NANORESTORE CLEANING® Polar Coating G

OVERVIEW

Nanorestore Cleaning® systems are particularly useful in the removal of oily soils and organic coatings without redeposition into the pores of the substrate. They offer performances not achievable with traditional solvents or solvent gels and represent a new platform for conservation of work of arts. Nanostructured cleaning fluids (water-in-oil microemulsions, micellar solutions) are substantially based on water, with a drastically reduced solvent content while maintaining cleaning effectiveness.

Nanorestore Cleaning® Polar Coating G

Water-based nanostructured fluid containing a non-ionic alcohol ethoxylate surfactant and a mixture of methyl ethyl ketone (MEK), 2-butanol, ethyl acetate, and propylene carbonate. This formulation is designed for the removal of a wide range of polymeric coatings and (aged) natural and synthetic varnishes. This formulation can be safely used when the presence of salts is significant.

Preparation

Nanorestore Cleaning® Polar Coating G formulations is composed of two bottles, one of them containing ethyl acetate, which should be added to the nanostructured fluid right before the application. Once the ethyl acetate is added, the formulations are stable for several weeks. Therefore, it is advisable to prepare only the amount needed for the application. In the following, the formulae to calculate the amount of ethyl acetate to be added as a function of the final volume of the nanostructured fluid is reported.

NANORESTORE CLEANING® POLAR COATING G

1. Ethyl Acetate volume = (Total desired volume x 8) / 100
2. Nanorestore Cleaning® Polar Coating G volume = Total desired volume – Ethyl Acetate volume

WHEN ARE THEY USED?

The formulations of Nanorestore Cleaning® can be used for the removal of oily soils, grime or (aged) organic coatings from the surface of (porous) works of art, to overcome the drawbacks of traditional cleaning methods (i.e., limited control on the cleaning action of neat organic solvents, spreading of the dissolved material, toxicity issues), or when neat organic solvents do not provide satisfactory results.

OK to be used for

1. Removal of hydro soluble dirt, grime or dust from mural paintings and stone artefacts
2. Removal of (aged) coatings, such as acrylic and vinyl synthetic polymers and (aged) natural and synthetic varnishes from mural paintings and stone artefacts

HOW DO THEY WORK?

Nanorestore Cleaning® formulations possess excellent detergency properties thanks to their vast interface and the combined action of solvents and surfactants. Primarily, nanostructured fluids, such as micelles and microemulsions, promote the swelling and detachment of detrimental coatings from the surface of the works of art, through different mechanisms to those involved in the use of neat solvents, solvents blends or solvent gels. Overall, the spreading of dissolved/detached matter through the pores of the work of art is limited as compared to the direct use of solvents. Moreover, the environmental impact is minimized, and the safety of the operator increased. Finally, all the Nanorestore Cleaning® formulations can be confined in Nanorestore Gels®, allowing for better control of the cleaning action and expanding their applicability to water-sensitive works of art – for more details about this application, please refer to Nanorestore Gels® Technical Sheet.

HOW ARE THEY USED?

General features

Nanorestore Cleaning® formulations are designed for the removal of detrimental coatings from mural paintings, stone artefacts, or other non-water-sensitive substrates, where they are applied confined in a compress (such as a cellulose pulp poultice). However, they can also be confined in Nanorestore Gels® and applied on water-sensitive surfaces for the cleaning of different classes of works of art. For the application of Nanorestore Cleaning® formulations confined in a gel network, please refer to Nanorestore Gels® Technical Sheet.

Storage

Nanorestore Cleaning® formulations are shipped in HDPE white bottles, in which it is advised to store them. In these containers, the formulations are stable and can be conserved at room temperature for several months before the use. However, after long storage time, it is advisable to check Nanorestore Cleaning® formulations before the application.

Safety

Nanorestore Cleaning® formulations have a very low environmental and health impact. Organic solvent, whose amount is usually less than 25 % (w / w), are confined as droplets within the surfactant aggregates. Even though, the smell of these systems can be fastidious and some ventilation during the application is advisable. Nanorestore Cleaning® formulations should be handled wearing standard laboratory gloves according to common laboratory practice.

Preliminary tests

To check the compatibility between Nanorestore Cleaning® formulations and the original artworks that need to be treated, it is advisable to perform some preliminary tests using a cotton swab soaked into the nanostructured fluid. In case you notice an undesired effect on the materials of the work of art, do not proceed with the application. However, it is essential to note that a poor result of this preliminary test does not necessarily indicate that the cleaning system will not work in a further application. Nanorestore Cleaning® formulations are designed to be applied for longer times confined in poultices or gels; therefore, they could be poorly effective if applied for a few seconds with a cotton swab.

Application

For the application, Nanorestore Cleaning® formulation should be mixed with cellulose pulp (such as BC200 (average fibre length 0.3 mm) or BWW40 (average fibre length 0.2 mm) Arbocel® powder); usually, for each gram of cleaning fluid 0.3 - 0.4 g of cellulose pulp are used, to obtain a wet, but not dripping, poultice (Fig. 1 - 3). The wet cellulose pulp should be evenly distributed over a Japanese paper sheet (grammage 8.6 - 11g/m²) placed in contact with the coating to be removed (Fig. 4 - 5). Poultice thickness may range from few millimetres to 10 - 20 mm. For the removal of thin polymer coatings from mural paintings, it can be estimated that 1.5 - 3 litres per m² are needed. The amount required for the cleaning of stones of other artefacts is strongly dependent on the substrate's porosity, nature of the undesired substance and other parameters, thus it is hardly estimable a priori.

Reducing evaporation

If the relative humidity is low (RH < 40 %), a plastic film (e.g., Melinex®, or others) or an aluminium wrap can be placed over the poultice to reduce the evaporation rate of Nanorestore Cleaning® formulation. It is vital to check the solubility of the chosen film in the cleaning fluid before the application.

Application time

Application time strongly depends on the type of material to be removed and on the surface to be treated. In general, application time ranges from 120 to 180 minutes (Fig. 6 - 7). In the case of lengthy application, it is mandatory to avoid the drying of the poultice (see above). Note that repeated applications can be performed. In some cases, two or more short applications lead to better results than a single lengthy application.

Removal and mechanical action (optional)

Depending on the chemical nature of the undesired materials, Nanorestore Cleaning® formulations can directly remove the unwanted material or swell and soften it. In the first case, the material to be removed migrates into the poultice; thus, after its removal, the surface appears clean. In the second case, after the removal of poultice, swollen and soften residues of the unwanted material may be present on the surface; in this case, a gentle mechanical action using dry or humid cotton swab is usually enough to maximize cleaning effectiveness (Fig. 8).

Final clearance

After the application of Nanorestore Cleaning® formulations, the removal of possible small residues of surfactant is recommended. If the surface to be treated is in good condition, this operation can be performed with a humid sponge (Fig. 9 - 10). In the case of degraded works of art, the final clearance should be carried out using a wet cellulose pulp compress applied over the Japanese paper (Fig. 11). The compress should be removed only when dry (Fig. 12 - 13). This operation must be carried out only when the treated area is completely dry. If some residues of the swollen polymer are left on the surface, they can favour the contamination by cellulose fibres coming from the poultice. However, as a general rule, when possible, clearing the surfactant with a water-soaked natural sponge is the best choice. To be sure that all the surfactant is removed from the surface, 2 - 3 rinsing cycles should be carried out (by using a sponge, you will see no more lathering when surfactant residues are completely removed).

APPLICATION GUIDELINES AT A GLANCE

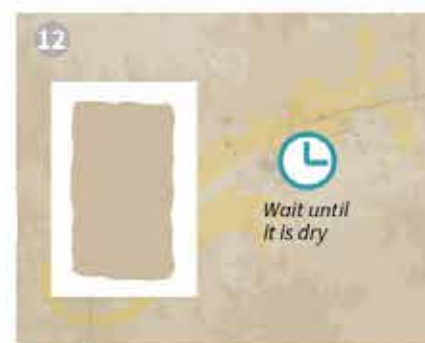
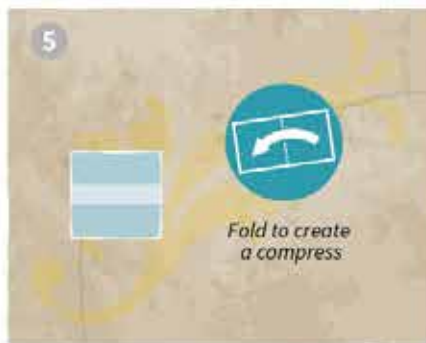
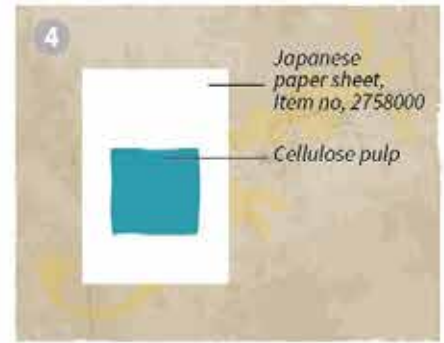
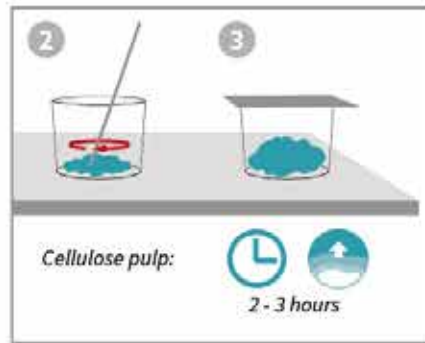
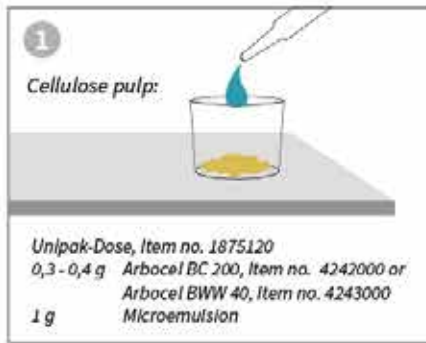
Goggles	Yes
Gloves	Yes
Ventilated hood or environment	Recommended whenever possible
Application time	60-180 minutes, depending on the specific case
Residues after cleaning	Possibly surfactants, removable after final clearance
Final clearance	Rinse with water using a natural sponge (for surfaces in right conditions) or a cellulose pulp poultice applied over Japanese paper (for degraded surfaces)

Illustration description

- (1 - 4) A cellulose pulp poultice soaked with one of the Nanorestore Cleaning® formulations is applied over a Japanese paper sheet.
- (5) The Japanese paper is folded to create a compress, which is easily removable at the end of the cleaning.
- (6) Application time ranges from 60 to 180 minutes.
- (7) The compress is gently removed from the substrate.
- (8) If swollen and soften residues of the unwanted material are present on the surface, a gentle mechanical action using a dry or humid cotton swab is usually enough to maximize cleaning effectiveness.
- (9) Now the surface is clean.
- (10) After the application of Nanorestore Cleaning® formulations, the removal of possible small residues of surfactant is recommended. If the surface to be treated is in good condition, this operation can be performed with a humid sponge.
- (11) In the case of degraded works of art, the final clearance should be carried out using a humid cellulose pulp compress applied over the Japanese paper.
- (12) The poultice should be removed only when dry.
- (13) The surface is now clean, and no surfactant residues should be present.

Cleaning a surface or removing a coating using a poultice of cellulose

NANORESTORE MICROEMULSION



FREQUENTLY ASKED QUESTIONS

Q Can I reuse Nanorestore Cleaning® formulations after the application?

A Nanorestore Cleaning® formulations cannot be reused; after the application, system composition might change, potentially altering the cleaning effectiveness.

REFERENCES

Further information can be found in the following textbooks:

1. Piero Baglioni and David Chelazzi. Nanoscience for the Conservation of Works of Art. Royal Society of Chemistry, 2013.
2. Piero Baglioni, David Chelazzi, and Rodorico Giorgi. Nanotechnologies in the Conservation of Cultural Heritage: A Compendium of Materials and Techniques. Springer, 2014.

ICONOLOGIE - EXPLANATION OF THE SYMBOLS



Trocknen / *Drying*



Komprimieren, Zusammenfalten /
Compress, fold together



Schwamm / *Sponge*



Mit Schwamm trocknen /
Dry with sponge



Scalpell oder Cutter benutzen /
Use scalpel or cutter



Mit trockenem Wattestäbchen reinigen /
Clean with dry cotton swab



Zeit beachten / *Watch time*



Sprühen / *Spray*



Aufquellen / *Swelling, soaking*



Messen, Analysieren /
Measuring, analysing



Richtig, fertig / *right, finished*