

# NANORESTORE GEL® DRY

## Technical Sheet

### OVERVIEW

Nanorestore Gel® Dry are water-based chemical gels, which leave no residues on the surface of the treated artifacts. Thanks to their highly retentive network they can be used also on water-sensitive surfaces because their action is limited to the interface, thus only a small amount of liquid is released to the surface. Nanorestore Gel® Dry are sold loaded with water, but they can be also loaded with polar solvents (such as ethanol) or water-based nanostructured fluids of the Nanorestore Cleaning® series.

### AVAILABLE FORMULATIONS

#### Nanorestore Gel® Medium Water Retention - MWR (formerly known as “Extra Dry”):

Transparent chemical hydrogel based on a pHEMA/PVP semiinterpenetrated network having very high retention of loaded liquid. Can be safely used on particularly water-sensitive substrates. Each package contains a water-loaded sheet (approx. 10 cm x 15 cm x 2 mm), which can be reused up to 5 times, depending on the specific case.

#### Nanorestore Gel® High Water Retention - HWR (formerly known as “Max Dry”):

Transparent chemical hydrogel based on a pHEMA/PVP semiinterpenetrated network having the maximum retention of loaded liquid. Can be safely used on substrates that cannot tolerate water. Each package contains a water-loaded sheet (approx. 10 cm x 15 cm x 2 mm), which can be reused up to 5 times, depending on the specific case.

### WHEN ARE THEY USED?

Cleaning of water-sensitive (painted) surfaces is a very delicate operation, since detergent systems have to perform a selective and controlled action to remove grime, dirt and/or aged varnishes without affecting the original materials and/or the underlying pictorial layer. Gels are usually used for this purpose. Traditional gelled systems offer quite good performances, but their nature makes them very hard to be removed from the cleaned surface and might produce irreversible damages to the pictorial layer. Nanorestore Gels® Dry are designed to overcome the limits of traditional gels.

#### OK to be used for

- ✓ Removal of hydrosoluble dirt, grime or dust from canvas paintings
- ✓ Removal of hydrosoluble dirt, grime or dust from paper (pay attention to the presence of hydrosoluble inks or pigments)
- ✓ Removal of hydrosoluble dirt, grime or dust from paintings on wood
- ✓ Removal of hydrosoluble dirt, grime or dust from parchment or leather
- ✓ Removal of aged varnishes from canvas paintings (in this case Nanorestore Gels® Dry need to be loaded with solvents or Nanorestore Cleaning® formulations)
- ✓ Removal of (aged) adhesives or polymeric coatings from paper or other water-sensitive materials

***\* For different applications, it is advised to contact us for assistance. We will be glad to help you in finding the best solution for your conservative need***

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## HOW DO THEY WORK?

They are used as vehicle (containers) for the liquid cleaning agent. Nanorestore Gels® Dry can remove grime, dirt and/or aged varnishes by solubilization or swelling/detachment of unwanted material. They prevent the cleaning agent from fast evaporation and uncontrolled penetration into porous materials making the cleaning safer. Moreover, thanks to their formulation they do not leave residues on the treated surfaces.

## HOW ARE THEY USED?

### General features

Nanorestore Gel® Dry can be used loaded with water, aqueous solutions, several solvents or waterbased nanostructured fluids of the Nanorestore Cleaning® series.

### Storage

Nanorestore Gel® Dry are shipped immersed in a small volume of demineralized water. The gels are stable, and can be conserved at room temperature for several months before the use. When gels are removed from the original packages they should be stored immersed in water in closed containers, kept in the dark. Wait at least 24 hours before the first usage. It is advisable to check gels after long a storage time, in order to verify that no alteration has occurred. Though the gels should be quite resistant to microorganisms, they can be subjected to biological contamination, if not properly handled. In case a biological attack is noticed, the gels can be washed with a 1% sodium hypochlorite solution for 1-2 minutes, carefully rinsed with water in order to remove the hypochlorite, and stored in clean water. Before the use, make sure that biological contamination was completely removed from the gels.

### Safety

Nanorestore Gel® Dry are non-toxic, thus they can be handled with standard laboratory gloves according to common laboratory practice. When solvent-loaded gels are used, we recommend to follow all the standard precautions related to the use of organic solvents, even if when solvents are confined into the gels, their volatility is reduced, therefore the exposition of the user to solvent vapors is decreased.

### Application

When Nanorestore Gel® Dry are removed from their container (or their original package), they can be cut down and shaped in the desired size and form. Then, prior to application, water excess on the gel surface has to be removed by gently placing for 1-2 seconds each side of the gel on a sheet of absorbing paper (**Fig. 1 a.1** or **Fig. 2 a.2**). Finally, the gel can be applied on the surface to be treated (**Fig. 1 a.2** or **Fig. 2 a.3**). Just lay the gel on the surface that has to be cleaned, using hands or tweezers, and apply a little pressure, in order to optimize the adhesion of the gel to the surface.

### Reducing evaporation (optional)

If needed, a plastic film can be placed over Nanorestore Gels® Dry keep the gel wet during the cleaning operation, reducing the evaporation of water (**Fig. 1 a.3** or **Fig. 2 a.4**). It is worth noting that in case of standard operations, this procedure is not needed, being the application time short if compared to the evaporation time of water confined in gel network.

### Application time

Application time strongly depends on the type of gel, the materials to be removed and the surface from which they should be removed. In general, the application time can vary from a minute up to 3-4 hours (**Fig. 1a.4** or **Fig. 2a.5**). In the case of long application, it is mandatory to protect the gel from water evaporation, in order to avoid the drying of Nanorestore Gel® Dry (see above).

### Removal

Nanorestore Gels® Dry can be removed from the treated surface by using tweezers or by delicately peeling the gel (**Fig. 1b.5** or **Fig. 2b.6**).

### Mechanical action

If the application of Nanorestore Gels® Dry leads to the swelling of grime, dirt and/or aged varnishes, the removal of swollen and soften materials should be carried out by a gentle mechanical action (e.g. using a swab) (**Fig. 1b.6b** or **Fig. 2b.7b**). On the other hand, when unwanted material is solubilized, the mechanical action is not needed, being the dirt/grime entrapped into the gel network (**Fig. 1b.6a** or **Fig. 2b.7a**).

### Repeated applications

Nanorestore Gels® Dry can be used in a single application or in short repeated applications. In this case, it is important to check if gel is still humid before re-applying it. If not, it is advisable to use another piece of gel, following the procedure described into the “Application” section.

### Reusing the gel

Nanorestore Gel® Dry can be used several times after the first application, provided that they are immersed in water overnight or at least for 12h, to re-load pure water and release dirt/grime (**Fig. 1b.8**). For instance, Nanorestore Gels® Dry can be used up to 4-5 times for the removal of dirt and dust. However, it is worth noting that the cleaning effectiveness might decrease after each application. Long-term storage of Nanorestore Gels® Dry following the first use is not advisable.

### Loading of solvents or other liquids

Loading Nanorestore Gels® Dry with solvents (e.g. glycols, alcohols, ethanolamine), water-solvent blends (e.g. water and ethanol) or Nanorestore Cleaning® aqueous formulations can be carried out by immersing the original water-loaded gel into the desired cleaning fluid for at least 12 hours (**Fig. 2a.1**). The gel can be reused up to 5 times, by re-immersing it into the solvent or Nanorestore Cleaning® formulation. Please note that, once loaded, gels cannot be immersed in water or in other cleaning fluids (i.e., they should be stored in the loaded cleaning formulation).

List of chemicals that can be loaded into Nanorestore Gel® Dry:

- ✓ Benzyl alcohol
- ✓ Acetic acid
- ✓ Ethylene glycol
- ✓ 2-Methoxyethanol (Methyl cellosolve)
- ✓ Ethanolamine
- ✓ Propylene glycol
- ✓ Ethanol
- ✓ Methanol
- ✓ 2-Butanol
- ✓ 2-Propanol

List of chemicals that cannot be loaded into Nanorestore Gel® Dry:

- ✗ Acetone
- ✗ Butyl Acetate
- ✗ Cyclohexane

- ✘ Ethyl acetate
- ✘ Heptane
- ✘ Methyl ethyl ketone
- ✘ 1-Pentanol
- ✘ Propylene carbonate
- ✘ Toluene
- ✘ Xylene

### Final clearance

After the application of Nanorestore Cleaning®-loaded gels, a final clearance can be carried out using Nanorestore Gels® Dry simply loaded with water, aimed at removing water-soluble non-volatile components, which in some cases might remain as a residue over the treated surface.

## APPLICATION GUIDELINES AT A GLANCE

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**Goggles** No

**Gloves** Yes

**Ventilated hood or environment** Only if loaded with solvents

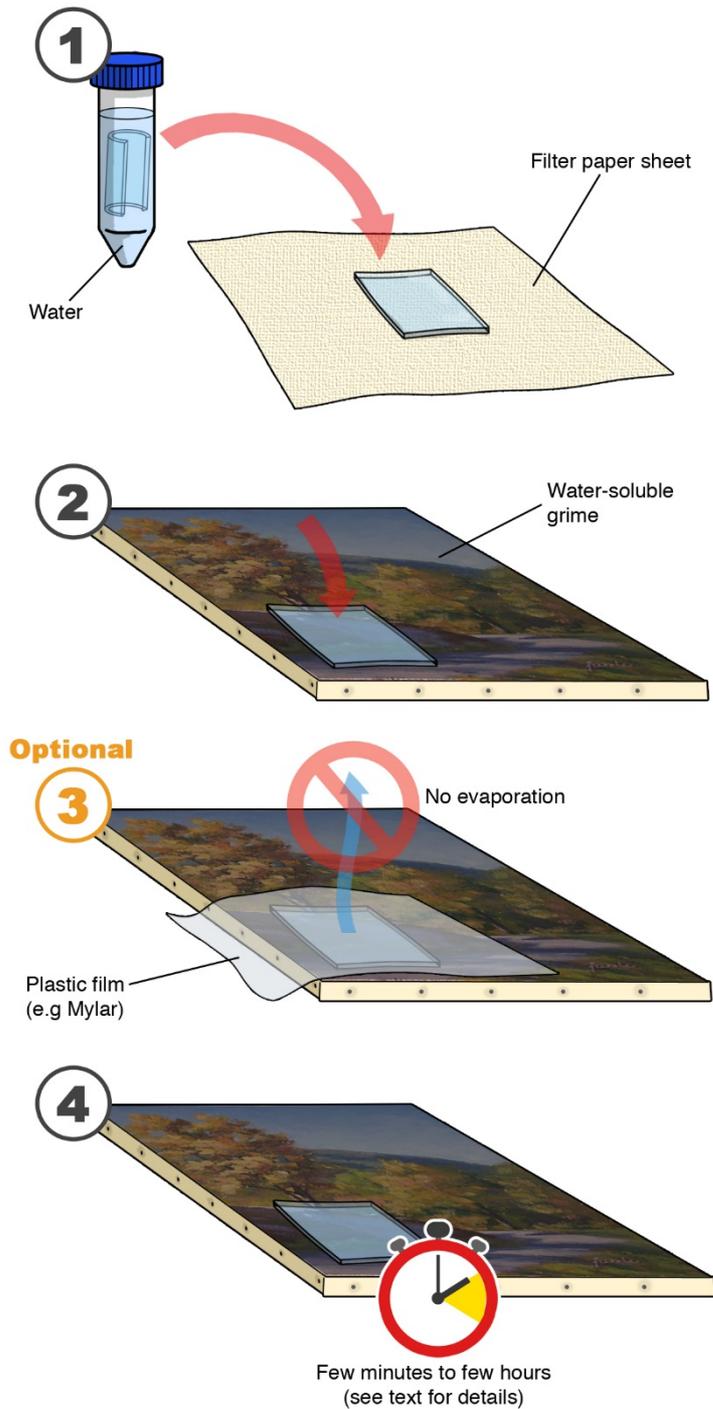
**Application time** 1-5 minutes (to 3-4 hours), depending on the specific case

**Residues after cleaning** Possibly surfactants, only if loaded with Nanorestore Cleaning® formulations

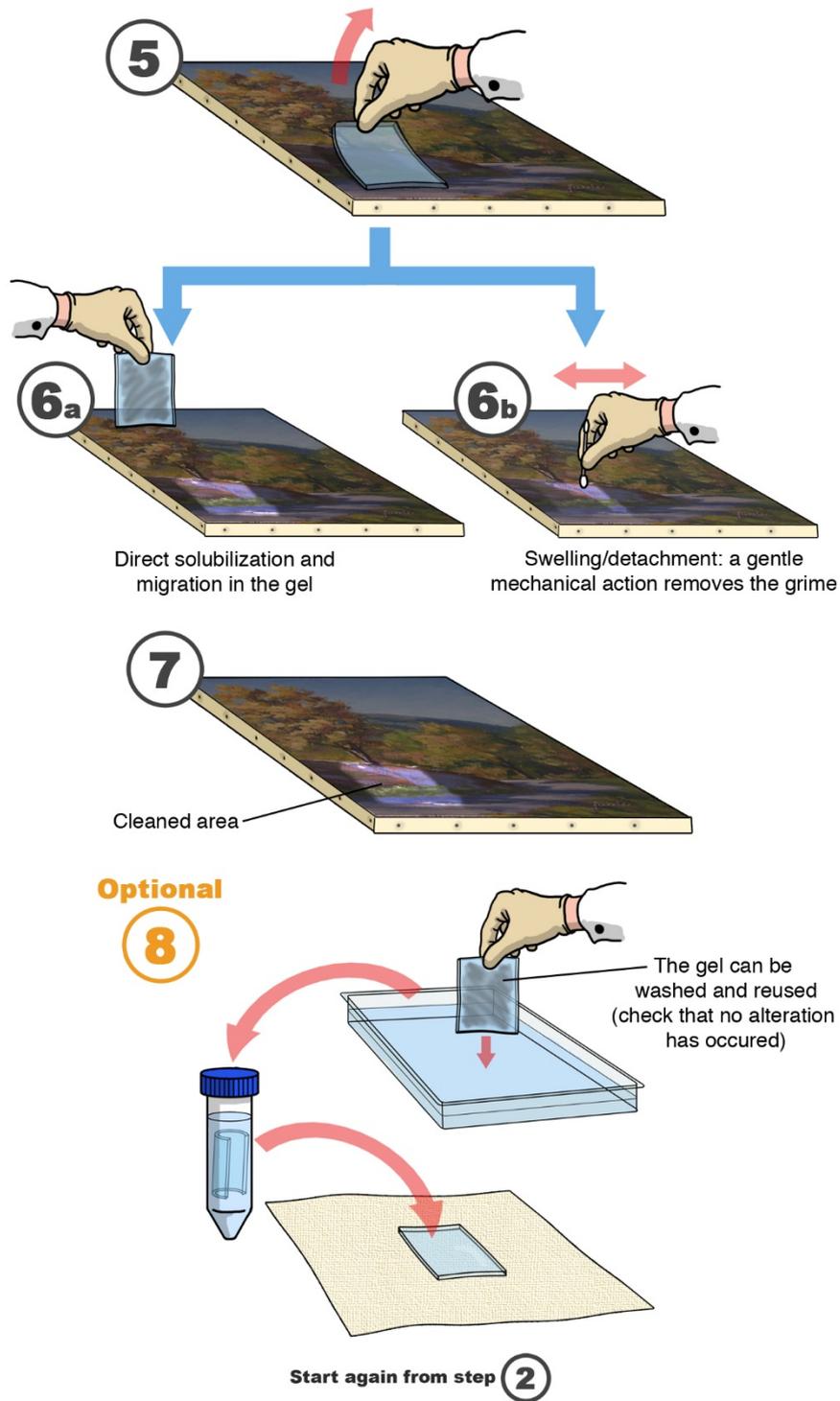
**Final clearance** Rinse with water (or apply a water-loaded gel) if surfactants residues can be present, only if Nanorestore Cleaning®-loaded gels have been used

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## FIGURES



**Figure 1a.** Application of Nanorestore Gel® Dry for the removal of hydrosoluble dirt.  
(1) Water excess on the gel surface has to be removed by gently placing for 1-2 seconds each side of the gel on a sheet of absorbing paper  
(2) Place the gel over the surface.  
(3) Use a plastic film to avoid liquid evaporation. (Optional)  
(4) Application time ranges from few minutes to 3-4 hours.



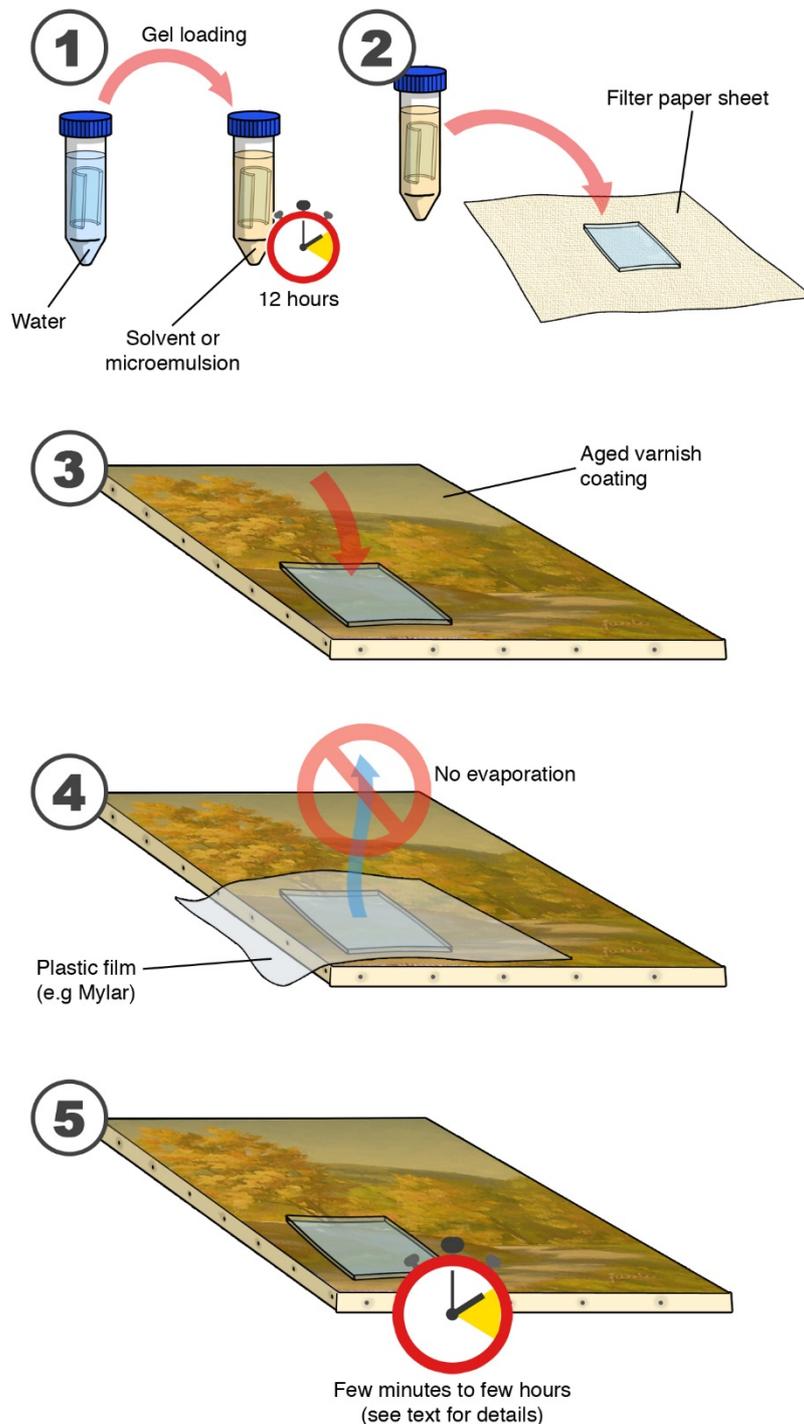
**Figure 1b.** Application of Nanorestore Gel® Dry for the removal of hydrosoluble dirt.

(5) Remove the gel.

(6) When the unwanted material is solubilized, a mechanical action is not needed, being the dirt/grime entrapped into the gel network (a). If the application leads to the swelling of grime or dirt, the removal of swollen and soften materials should be carried out by a gentle mechanical action (e.g. using a swab) (b).

(7) The treated area is now clean.

(8) The gel can be reused up to 5 times, by re-immersing it in water.



**Figure 2a.** Application of Nanorestore Gel® Dry (loaded with solvents or Nanorestore Cleaning® formulations) for the removal of polymeric coatings or varnishes.

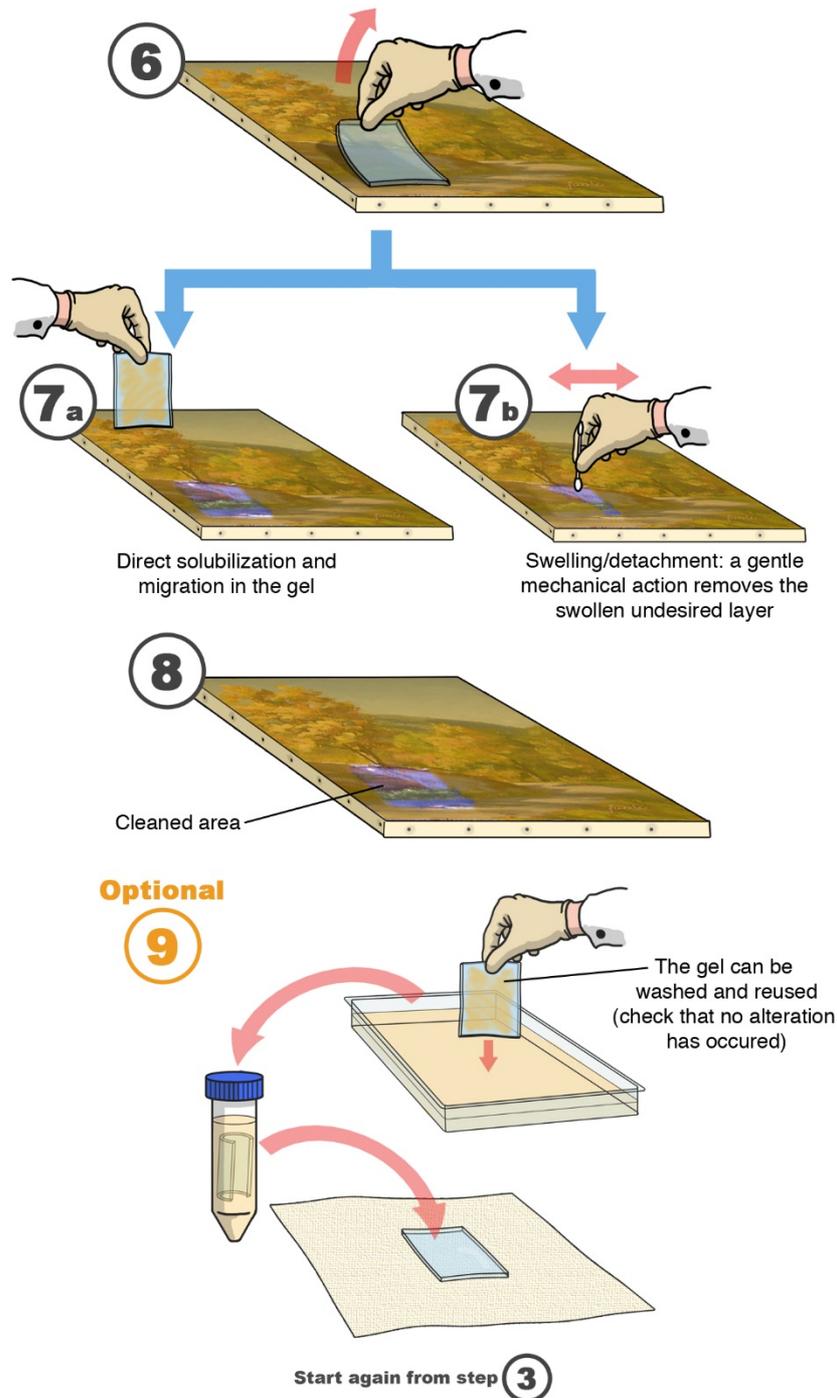
(1) Loading Nanorestore Gels® Dry with solvents (e.g. glycols, alcohols, ethanolamine), water-solvent blends (e.g. water and ethanol) or Nanorestore Cleaning® aqueous formulations can be carried out by immersing the original water-loaded gel into the desired cleaning fluid for at least 12 hours

(2) Liquid excess on the gel surface has to be removed by gently placing for 1-2 seconds each side of the gel on a sheet of absorbing paper

(3) Place the gel over the surface.

(4) Use a plastic film to avoid liquid evaporation. (Mandatory in this case.)

(5) Application time ranges from few minutes to 3-4 hours.



**Figure 2b.** Application of Nanorestore Gel® Dry (loaded with solvents or Nanorestore Cleaning® formulations) for the removal of polymeric coatings or varnishes.

(6) Remove the gel.

(7) When the unwanted material is solubilized, a mechanical action is not needed, being the dissolved material entrapped into the gel network (a). If the application leads to the swelling of the polymeric coating and/or aged varnishes, the removal of swollen and softened materials should be carried out by a gentle mechanical action (e.g. using a swab) (b).

(8) The treated area is now clean.

(9) The gel can be reused up to 5 times, by re-immersing it into the solvent or Nanorestore Cleaning® formulation.

## FREQUENTLY ASKED QUESTIONS

**Q** I forgot to put back into the container the Nanorestore Gel® Dry and now it is completely dried. Can I reuse it, if rehydrated?

**A** No, completely dried gel cannot be reused, even if rehydrated. As a matter of fact, the complete drying of Nanorestore Gel® Dry could affect the cleaning effectiveness of the system.

## REFERENCES

Further information can be found in the following textbooks:

1. Piero Baglioni e David Chelazzi. *Nanoscience for the Conservation of Works of Art*. Royal Society of Chemistry, 2013.

2. Piero Baglioni, David Chelazzi e Rodorico Giorgi. *Nanotechnologies in the Conservation of Cultural Heritage: A Compendium of Materials and Techniques*. Springer, 2014.

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