deffner & Johann

Supplies for RESTORATION | CONSERVATION | ART HANDLING – SINCE 1880.

TECHNICAL DATA SHEET

2093 004 | Nanorestore Paper®, Propanol 3

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NANORESTORE Paper® Propanol 3

OVERVIEW

Nanorestore Paper® dispersions are used for the pH control and deacidification of cellulose-based artefacts. The use of nanoparticles grants good penetration into the porous substrate, quick neutralization of the pH, and the formation of an alkaline buffer. These systems represent an alternative to methods that use micron-sized particles and precursors of hydroxides (or carbonates). The use of organic solvents makes Nanorestore Paper formulations® compatible with water-sensitive substrates.

AVAILABLE FORMULATIONS

Nanorestore Paper® Ethanol 3:

Calcium hydroxide nanoparticles dispersed in ethanol at a concentration of 3 g/l. These particles are designed explicitly for pH control and deacidification purposes.

Nanorestore Paper® Ethanol 5:

Calcium hydroxide nanoparticles dispersed in ethanol at a concentration of 5 g/l. These particles are designed explicitly for pH control and deacidification purposes.

Nanorestore Paper® Propanol 3:

Calcium hydroxide nanoparticles dispersed in 2-propanol at a concentration of 3 g/l. These particles are specifically designed for pH control and deacidification purposes.

Nanorestore Paper® Propanol 5:

Calcium hydroxide nanoparticles dispersed in 2-propanol at a concentration of 5 g/l. These particles are specifically designed for pH control and deacidification purposes.

Nanorestore Paper® Test Kit:

This kit includes 100 ml of Nanorestore Paper® Ethanol 3 and Nanorestore Paper® Propanol 3. It could be used for preliminary tests to choose the best formulation for your specific needs.

WHEN ARE THEY USED?

Acidity affects several types of artworks, leading to their weakening. For instance, cellulose-based artefacts, such as paper, wood, and canvas exhibit loss of mechanical properties due to acid hydrolysis of cellulose. It is, therefore, necessary to counteract acidity through the neutralization of the pH and the application of an alkaline buffer on the endangered material. Nanorestore Paper® dispersions are specifically designed for the pH control and deacidification of these artefacts.

OK to be used for...

... Deacidification and pH control of the blank paper
... Deacidification and pH control of printed books
... Deacidification and pH control of iron and metal gall ink manuscripts
... Deacidification and pH control of wooden artefacts
... Deacidification and pH control of canvas, i.e., the backside of easel paintings

HOW DO THEY WORK?

Calcium hydroxide nanoparticles of Nanorestore Paper® formulations adhere to the cellulose fibres and rapidly neutralize acidity on site. The excess of particles reacts with CO2 in the atmosphere, turning into carbonate, granting protection against reoccurring acidity.

HOW ARE THEY USED?

General features

Nanorestore Paper® formulations are specifically designed for the pH control and deacidification of cellulose-based artefacts. Calcium hydroxide nanoparticles are used to raise the artefact's pH around neutrality (7.0 - 8.0). Neutrality prevents the degradation of cellulose due to acid-catalyzed hydrolysis and also hampers metal-catalyzed oxidation.

Storage

Nanorestore Paper® dispersions are shipped in HPDE bottles, which should be kept firmly closed to prevent the contact between calcium hydroxide nanoparticles and air, to avoid the clustering of particles and their carbonation. The contact between nanoparticle dispersions and humidity has to be avoided too. Water doesn't affect the effectiveness of Nanorestore Paper®, but it may cause changes in nanoparticle size. Bigger particles than the ones initially present may result in a white haze on the treated surfaces, which has to be promptly removed. Nanorestore Paper® formulations contain no additives and are formulated to prevent sedimentation. Even though, after extended storage, it is recommended to shake the dispersion energetically before use.

Safety

Nanorestore Paper® dispersions should be handled with care, following the same standard operating procedure recommended for ethanol and 2-propanol. Therefore, the formulations must be used in the presence of proper air ventilation and should be handled wearing goggles and gloves. Nanorestore Paper® dispersions cannot be used in the presence of open flames, sparks, and hot surfaces.

Preliminary tests

Before the application, pH measurements on the substrate should be carried out (Fig. 2 - 3). Depending on the type of artefacts, the measure can be carried out by cold extraction (TAPPI T 509 Om-2, ASTM D778-97 2002) or on the surface (TAPPI T529 Om-88). A deacidification treatment is needed when the measured pH is lower than 5.5. Before the application of Nanorestore Paper® dispersions, the compatibility between the artefacts and the chosen solvent should be checked (Fig.2). Solvents included in the Nanorestore Paper® formulations are suited for most of the interventions performed in restoration.

Dilution (optional)

Nanorestore Paper® dispersions are available at a concentration of 3 g/l or 5 g/l. It is worth noting that for standard applications, a concentration of 2.5 - 3 g/l is advisable. In the case of low porous substrate, white hazes can be seen on a treated surface. To avoid the formation of these hazes, each Nanorestore Paper® dispersion can be diluted to the appropriate concentration by using the corresponding pure and anhydrous solvent (the chosen solvent mustn't contain water).

Choosing the right amount of dispersion to be used

The calculation of the precise amount of nanoparticles needed to deacidify a substrate is not feasible in many practical cases, because several parameters, including starting pH, paper grammage, and substrate porosity, should be considered. Please, note that an excess of particles has positive effects because it grants the formation of an alkaline buffer on the treated surface. The suggested values reported below are based on real case studies, but it should be noted that the amounts needed may vary from case to case.

Example 1:
1l of Nanorestore Paper® dispersion at 3 g/l can be used for the neutralization of 24 m^2 of paper, having a starting pH of 5 and a grammage of 80 g/m^2.

Example 2:
1l of Nanorestore Paper® dispersion at 3 g/l can be used for the neutralization of 16 m^2 of paper having a starting pH of 4 and a grammage of 100 g/m^2.

Application

Nanorestore Paper® dispersions are typically applied either by brushing (3a), by spraying (3b) over the artefact's surface, or by immersion of the artefact into the dispersion (3c). If possible, both sides of the object should be treated, to grant a homogenous distribution of nanoparticles within the substrate. It has been reported that nebulization and spraying of dispersion can be used to avoid the solubilization of modern inks that are usually sensitive to alcohol. In general, it is advisable to saturate the substrate with nanoparticle dispersion, wait for the evaporation of the solvent and then apply the treatment again until the given volume of dispersion is applied.

After the application

After the application of Nanorestore Paper® dispersions, it is advisable to keep treated artefacts at about 60% RH and room temperature for 10-15 days, to favour the conversion of calcium hydroxide to carbonate (Fig. 1.4), and then check the pH (Fig. 1.5). If the pH is lower than 7, it is recommended to apply the dispersion again until neutrality is reached. If the formation of an alkaline reserve is desired, a higher amount of Nanorestore Paper® should be applied after neutralization. The following values are based on real case studies, but it should be noted that the amounts needed may vary from case to case.

Example 1:
For paper having a starting pH of 5 and a grammage of 80 g/m^2, the formation of a 1 - 2% alkaline reserve requires the application of another 200 ml at 3 g/l concentration per square meter (100 ml front, 100 ml backside).

Example 2:
For paper having a starting pH of 4 and a grammage of 100 g/m^2, the formation of a 1 - 2% alkaline reserve requires the application of another 200 ml at 3g/l concentration per square meter (100 ml front, 100 ml backside).

APPLICATION GUIDELINES AT A GLANCE

Goggles	Yes
Gloves	Yes
Ventilated hood or environment	Recommended
Starting pH	Typically, deacidification is needed if pH is lower than 5.5
Recommended final pH	For standard application, pH should be around neutrality (7.0 - 8.0)

Explanation of the illustration

1 The compatibility between the artefact and the chosen solvent should be checked.

2 Before the application, a pH measurement on the substrate should be carried out.

3 Nanorestore Paper® is applied either by brushing (3a), by spraying (3b) or by immersion of the artefact into the dispersion (3c).

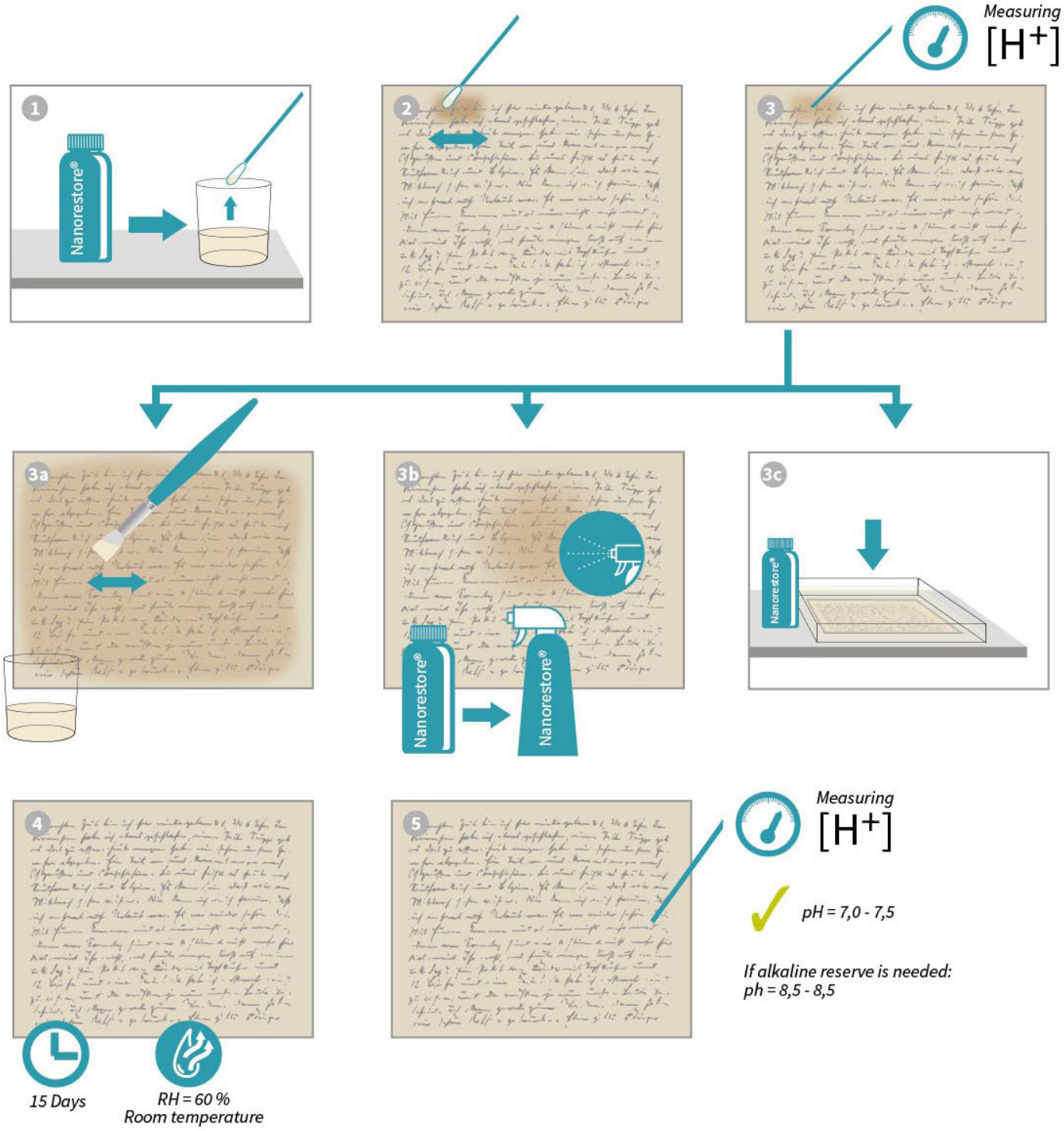
4 After the application, it is advisable to keep treated artefacts at about 60% RH and room temperature for 10-15 days, to favour the conversion of calcium hydroxide to carbonate.

5 Check the pH of the treated artefact.

Deacidification

PAPER ETHANOL 3, 5
Item no. 2093 000, 2093 002

PAPER PROPANOL 3, 5
Item no. 2093 004, 2093 006



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*