



NANOLAQ

NANOLIME IN AQUEOUS SUSPENSION

The compatible Green Consolidating Agent for architectural and artistic heritage

Technical Data Sheet

COMPATIBLE AND GREEN
CONSOLIDATING AGENT
FOR ARCHITECTURAL
AND ARTISTIC HERITAGE

Manufactured by:

SNAPTECH S.R.L.

SUSTAINABLE NANOPARTICLES PRODUCTION AND TECHNOLOGIES

Spin Off of the University of L'Aquila

Distributed by:

IBIX S.R.L.

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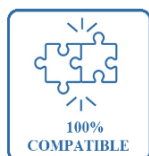
Consolidating product in the form of a suspension of **calcium hydroxide nanoparticles (Ca(OH)₂) dispersed in water**, obtained according to an **innovative and sustainable synthesis** procedure, which operates in water, at room temperature and ambient pressure, without the use of additives and without the emission of gases, dust and toxic or environmentally polluting waste (European patent EP2880101. 2016, University of L'Aquila).



Ideal for consolidating treatments perfectly compatible on all substrates with a carbonate matrix, such as *natural stone materials, historical mortars, plasters, frescoes, wall paintings, stuccoes*, which make up a large part of our cultural heritage.

During application, the combined action of the dimensions of the calcium hydroxide nanoparticles and the presence of water as a dispersing medium results in a high reactivity of NANOLAQ in the *carbonation process*, resulting in the formation of nano/micro crystals of calcium carbonate (CaCO₃) in the form of pure calcite. Thanks to its perfect chemical and crystallographic compatibility, the newly-formed calcite re-establishes the cohesion between the original grains, restoring the mechanical strength of the treated surface up to a depth of 1-2 cm or more, depending on the substrate, with no emission of volatile organic substances into the environment.

This process also allows 600g of CO₂ to be absorbed from the atmosphere for every 1,000 g of Ca(OH)₂ nanoparticles used, contributing to environmental friendliness from the production stage to final application.



EFFECTIVE AND GREEN PRODUCT

- Inorganic mineral product
- Obtained by a *sustainable synthesis process* with low environmental impact, extremely low energy consumption and no toxic waste production
- Perfectly compatible with all carbonate matrix substrates
- Effective in restoring surface cohesion and eliminating dusting
- It increases mechanical resistance up to at least a depth of 1 - 2 cm
- It does not alter the porosity of the original substrate, maintaining its “natural” transpirability
- Applicable on damp substrates
- Natural bacteriostatic and fungicide, (pH > 12)
- It does not release volatile organic substances into the environment, (zero VOC emissions)
- No CO₂ is produced during synthesis. After application, on the other hand, the product absorbs 600 g of CO₂ from the environment for every 1,000 g of nanoparticles used, with great benefit for the environment.



It restores the resistance of treated substrates up to a depth of 1-2 cm



It does not produce VOCs



It can also be applied on damp substrates



It absorbs CO₂ from the environment

FIELDS OF APPLICATION

NANOLAQ guarantees the compatible consolidation of all substrates with a carbonate matrix (such as natural stone materials, historical mortars, plasters, frescoes, wall paintings, stuccoes), both indoors and outdoors, respecting the environment and original materials.

Thanks to its reactivity and effectiveness, NANOLAQ restores the cohesion of treated substrates without changing their original chemical and physical composition, and without altering their appearance and breathability.

NANOLAQ is particularly suitable for extensive operations, in the presence of high humidity of the substrate and/or surroundings, and in closed environments.

INDICATIONS FOR USE

Preparation of the substrates

- 1) It is recommended that you clean the surface to be treated of dust, any biological tarnishes, etc.
- 2) In the event of the presence of hygroscopic salts (chlorides, nitrates, sulphates, ...), a desalinating treatment is recommended.
- 3) Lightly moisten the surface to be treated with water, especially in the case of highly absorbent substrates.
- 4) In the case of high temperature conditions, ($> 30\text{ }^{\circ}\text{C}$), it is advisable to operate with procedures that limit rapid evaporation, (maintenance of the substrate's damp conditions), thus furthering the regular absorption of CO_2 .

For Application of the Standard product

Vigorously shake the NANOLAQ suspension until completely uniform before application. Repeat shaking of the product during treatments or whenever product build-up is observed at the bottom of the container.

On natural stone materials and plaster, the product can be applied by airbrush directly onto the surface to be treated in order to promote penetration into the substrate. Alternatively, applications can be made using spray, brush or syringe systems, as required or depending on the type of substrate and type of degradation. In the case of very delicate surfaces or frescoes, we recommend the use of Japanese washi paper. It is advisable to carry out a test on a small area to be treated, before treating the entire area, in order to understand the quantity required to achieve an optimal consolidating result. You are also highly recommended to avoid dripping of the product, as this could lead to bleaching of the treated surface. If necessary, promptly blot up excess product with a sponge or dry cloth. The treatment can be repeated several times and, after each treatment, allow the treated substrate to dry, in order to allow the consolidating effect of NANOLAQ. The number of treatments to be carried out depends on the initial conditions of degradation of the surface and the degree of consolidation desired for the particular substrate.

In situations requiring more in-depth analysis

On request, IBIX staff can carry out an **application test** service as follows:

- Effective state diagnosis involving a peeling (or tear) test, using an adhesive tape with high homogeneity and known characteristics with particular regard to tensile strength and adhesion in accordance with ASTM D3759 and ASTM D 3330 respectively (e.g. 3M tape 1280).
- The test shall be carried out before and after (after 24h) the application of the NANOLAQ product.

Reference quantities

The application yield may vary depending on the substrate to be treated (porosity, state of decay, ...). On average, about 5 g/m^2 of nanoparticles are applied on slightly decohesive substrates, up to about 20 g/m^2 of nanoparticles on very decohesive substrates. Thus, the indicative yield of NANOLAQ at a concentration of 10 g/l can vary on average from 0.5 l/m^2 to at least 2 l/m^2 of product.

TECHNICAL DATA OF THE PRODUCT

Chemical nature	Calcium hydroxide, Ca(OH) ₂
Dimension range	10 – 100 nm
Suspension density	≈ 1 kg/dm ³ at 20 °C
Pack	1 litre / 5 litres
Storage	Always keep the packaging closed to avoid carbonation of the product. If correctly stored, the product has no expiry date.
Suspension pH	≥ 12
Application temperature limit	from + 5 °C to + 35 °C
Application yield	<i>indicatively</i> , from 5 to 20 g nanoparticles/m ² or, for suspensions with a concentration of 10 g/l, consumption varies from 0.5 to 2 litres/m ²

PRODUCT PERFORMANCE

With regard to the environment:

Production of CO ₂ during synthesis	absent
Absorption of carbon dioxide (CO ₂)	600 g/kg nanoparticles
Release of VOC	absent

With regard to the substrate:

Penetration depth	> 1 cm from the surface area
Increase in tear resistance	> 80% in decohesive substrates
Increase in pierce resistance	> 50% in decohesive substrates
Colour alteration	not perceivable
Alteration in porosity	negligible
Variation in water absorbed by capillarity	negligible
Alteration in breathability	negligible
Development of fungi and bacteria	none

THE CHOICE OF THE PRODUCTS

NANOLAQ – Basic range

NANOLAQ is available in different concentrations: 10 g/l, 20 g/l, 40 g/l.

It is possible to request NANOLAQ with different concentrations on specific request for particular situations.

NANOLAQ-_{FE} – Specific formulations

NANOLAQ-_{FE} features an innovative formulation containing nano-structured calcium and iron compounds, which is ideal for optimising the product's colour compatibility with all substrates in the ochre-havana brown shade range. In this case, customised formulations can be developed on request according to the specific shade of the substrate to be treated.

PATENTS

- R. Volpe, G. Taglieri, V. Daniele, G. Del Re, "A process for the synthesis of $\text{Ca}(\text{OH})_2$ nanoparticles by means of ionic exchange resin", *European patent EP2880101*, 2016
- G. Taglieri, L. Macera, V. Daniele, "Procedimento per la sintesi di nanoparticelle di Ossido di Calcio e Ferro idrato, $\text{Ca}_4\text{Fe}_2\text{O}_7 \cdot 13\text{H}_2\text{O}$, mediante resine a scambio ionico", Italian Patent being Filed

SCIENTIFIC REFERENCES

- G. Taglieri, V. Daniele, G. Del Re, R. Volpe, "A new and original method to produce $\text{Ca}(\text{OH})_2$ nanoparticles by using an anion exchange resin", *Advances in Nanoparticles*, vol. 4, pages 17-24 (2015). ISSN Print: 2169-0510, ISSN Online: 2169-0529
- G. Taglieri, L. Arrizza, V. Daniele, C. Masciocchi, F. Papola, E. Iacomino, L. Ventura, "Application of nanoparticles in consolidation treatments of archeological bones", *Pathologica*, 107(3-4), 107 (2015)
- G. Taglieri, B. Felice, V. Daniele, R. Volpe, C. Mondelli, Analysis of the carbonatation process of nanosized $\text{Ca}(\text{OH})_2$ particles synthesized by exchange ion process, *Journal of Nanoengineering and Nanosystems*, 230(1), 25–31, (2016)
- G. Taglieri, V. Daniele, L. Macera, C. Mondelli, "Nano $\text{Ca}(\text{OH})_2$ synthesis using a cost-effective and innovative method: Reactivity study", *Journal of American Ceramic Society* 100, 5766–5778 (2017)
- G. Taglieri, J. Otero, V. Daniele, G. Gioia, L. Macera, V. Starinieri, A.E. Charola, "The biocalcarene stone of Agrigento (Italy): preliminary investigations of compatible nanolime treatments", *Journal of Cultural Heritage*, 30, 92-99 (2018)
- V. Daniele, G. Taglieri, L. Macera, G. Rosatelli, J. Otero, A.E. Charola, "Green approach for an eco-compatible consolidation of the Agrigento biocalcarenes surface", *Construction and Building Materials* 186, (2018) pp. 1188–1199 (2018)
- G. Taglieri, V. Daniele, L. Macera, L. Arrizza, "Synthesizing alkaline earth metal hydroxides nanoparticles through an innovative, single-step and eco-friendly method", *Solid State Phenomena*, 286, 3-14 (2019)
- G. Taglieri, V. Daniele, L. Macera, A. Mignemi, Innovative and green nanolime treatment tailored to consolidate the original mortar of the façade of a medieval building in L'Aquila (Italy), *Construction and Building Materials* 221, 643–650 (2019)
- G. Taglieri, V. Daniele, L. Macera, R. Schweinz, S. Zorzi, M. Capron, G. Chamaut, C. Mondelli, "Sustainable Nanotechnologies for Curative and Preventive Wood Deacidification Treatments: An Eco-Friendly and Innovative Approach", *Nanomaterials*, 10(9), 1744 (2020)
- J. Otero, V. Starinieri, A.E. Charola, G. Taglieri, Influence of different types of solvent on the effectiveness of nanolime treatments on highly porous mortar substrates, *Construction and Building Materials* 230, 117112 (2020)
- L. Macera, L. Gigli, V. Daniele, J.R. Plaisier, L. Arrizza, G. Taglieri, "Synchrotron investigations of the nanolime reactivity on Biocalcarene stone surfaces", *Construction and Building Materials*, 262, (2020)
- L. Macera, V. Daniele, F. Duchetta, S. Casciani, G. Taglieri, "New nanolimes for eco-friendly and customized treatments to preserve the biocalcarenes of the "Valley of Temples" of Agrigento", *Construction and Building Materials* 306, 124811 (2021)

WARNINGS

Product for professional use.

It is recommended that the products not be used on surfaces exposed to temperatures > 30 °C to avoid rapid evaporation of the aqueous solvent.

NANOLAQ contains no additives.

If necessary, consult the safety data sheet.

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This information is up-dated as at November 2022.

The technical data sheet is drawn up to the best of our technical and applications knowledge. However, since we cannot directly intervene in the execution of the work, the technical data sheet contains general information that does not bind SNAPTECH S.r.l. in any way.