AMA

Art Media Agency

NEWSLETTER

358

19 February 2024

ECOLOGY

Starch Nanoparticle

ARR

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

ABOUT CONSOLIDANTS...

Within GREENART, Giovanna Poggi is part of the CSGI team, dedicated to coordination, overseeing the project and assessing the progress of research. Here, the researcher shares insights into the role of Work Package 4 and the development of consolidants.

Launched in October 2022, GREENART is an international project initiated by the European Union, bringing together researchers, conservators, and institutions from art conservation and restoration. Together, they collaborate to develop new, green, and sustainable restoration products such as cleaners, protective varnishes, consolidants, and monitoring technologies. No aspect of their development is overlooked. Through its various working groups — referred to as "Work Packages" — GREENART shares its progress.

Giovanna Poggi initially pursued studies in conservation-restoration at university but quickly shifted her focus towards chemistry within the cultural heritage domain during her bachelor's and master's degrees. She then embarked on a PhD focused on the development of innovative treatments for the preservation of cellulosic materials under the guidance of Professor Piero Baglioni — who is also involved in the GREENART project. Today, Giovanna Poggi holds a position as a researcher in physical chemistry at the Chemistry Department of the University of Florence. She has also participated in several projects at the Center for Colloid and Surface Science (CSGI): FP7 NANOFORART, H2020 NANORESTART, and now GREENART. There, she works with the CSGI coordination team, managing the scientific aspects of the project and evaluating the research progress.

Among the Work Packages of GREENART, Work Package 4 is dedicated to the development of new ecological consolidants. Giovanna Poggi elaborates on the role of consolidants in conservation/restoration and introduces the new products currently under development.

You are working on two classes of materials for the consolidation of cultural assets. Could you tell us more about this?

Work Package 4 (WP4) is specifically focused on the development of environmentally friendly consolidants and packaging materials. It involves various partners such as universities, research centres, and companies, as well as end-users. Regarding ecological consolidants, the CSGI, in collaboration with other developers, is concentrating on two categories of products: fibroin-based consolidants and starch nanoparticle-based consolidants.

Do they apply to the artwork's surface or the substrate?

Fibroin-based consolidants are optimised for strengthening silk textile materials, providing comprehensive reinforcement across the entire substrate. Conversely, starch nanoparticle-based consolidants are designed to enhance the cohesion of the artwork's surface.

— Antonio Mirabile

Compared to existing materials, in what way are they innovative?

Current consolidation systems used to reinforce substrates and restore the middle layers of artworks often consist of synthetic polymer solutions or dispersions. Although these materials exhibit high consolidating power, they frequently lack other essential qualities required for restoration materials. The ones we are developing are based on biopolymers, ensuring high compatibility with the original materials constituting the artwork. Moreover, due to their nanometric or submicrometric nature, our materials exhibit properties and performance that bulk materials could never achieve.

How are fibroin dispersions obtained? How do they work?

The development of this material stems from the need to create an effective system for consolidating silk while being compatible with this precious and traditional textile. In line with the Green Deal principles, we opted to use residual materials, specifically undyed silk remnants, from which we can extract fibroin, the main protein component of silk, through a relatively simple procedure. The fibroin, obtained in aqueous dispersion form, can then be applied to the original silk intended for consolidation, restoring its mechanical properties. Essentially, we are giving surplus silk a new purpose by using it as a basis to strengthen and preserve significant historical and artistic objects, thus creating a circular economy process. We are collaborating with our partners at the Universidade Estadual de Campinas (UNICAMP) in Brazil and exploring the possibilities of adding other biopolymers derived from agricultural waste — nanocelluloses — to the fibroin-based systems. Preliminary tests have shown that incorporating this material improves the consolidating efficiency of the fibroin-based product. This enhancement is particularly significant, especially considering the often precarious conditions of some silk fabrics.

What about the starch nanoparticles?

Synthetic polymers, known to form a thin, cohesive layer, can significantly alter the visual appearance of an artwork when used to reinforce the middle layer. This is particularly problematic for matte, porous, and weakly bound paint layers, often found in modern and contemporary artworks. To overcome the limitations of conventional methods, we chose to focus on synthesising starch nanoparticles, specifically derived from Jin Shofu starch, a traditional restoration product known for its excellent adhesive properties. The use of starch nanoparticles — typically measuring ten-billionths of a metre — on the middle layers of weakly bound artworks ensures effective penetration without compromising the object's aesthetic integrity. This results in a high consolidation effect thanks to their significant active surface area.

Can you tell more about sustainability?

Because GREENART regards this aspect as particularly significant, the project includes a dedicated Work Package for Life Cycle Safety and Sustainability Assessment, which involves all project partners and is coordinated by the research group from the University of Venice. Due to their nature and production procedures — which involve the use of eco-compatible reagents — we anticipate a very positive evaluation of the green consolidants I have mentioned.

What are the most important steps in evaluating the material before its use on an artwork?

First and foremost, a consolidant must fulfil its role in consolidation. Therefore, initial tests focus on assessing the reinforcement obtained after application. Depending on the type of intervention, whether it is to restore the substrate or to strengthen the middle layer of the artwork, different pre- and post-application tests are conducted. Since our work is focused on the development of materials intended for use in cultural heritage conservation, another essential property is examined: the alteration of the appearance of samples after treatment. If this change is deemed significant, it is likely that the products will not be applied to actual samples, unless they are applied to non-exposed areas of artworks, such as the back of paintings. Additionally, particular attention is paid to evaluating the new product's ageing and identifying any changes over time. Stability is a crucial property for materials used in restoration…

Do you think they will be ready for production and sale by the end of the project?

We are confident about the progress of product development by the end of the project. If the plan proceeds as anticipated, we envisage having at least one product tested and validated in the field, ready for the subsequent pre-commercialisation phase, namely, the preparation of the prototype.

Photo Sonika Agarwal

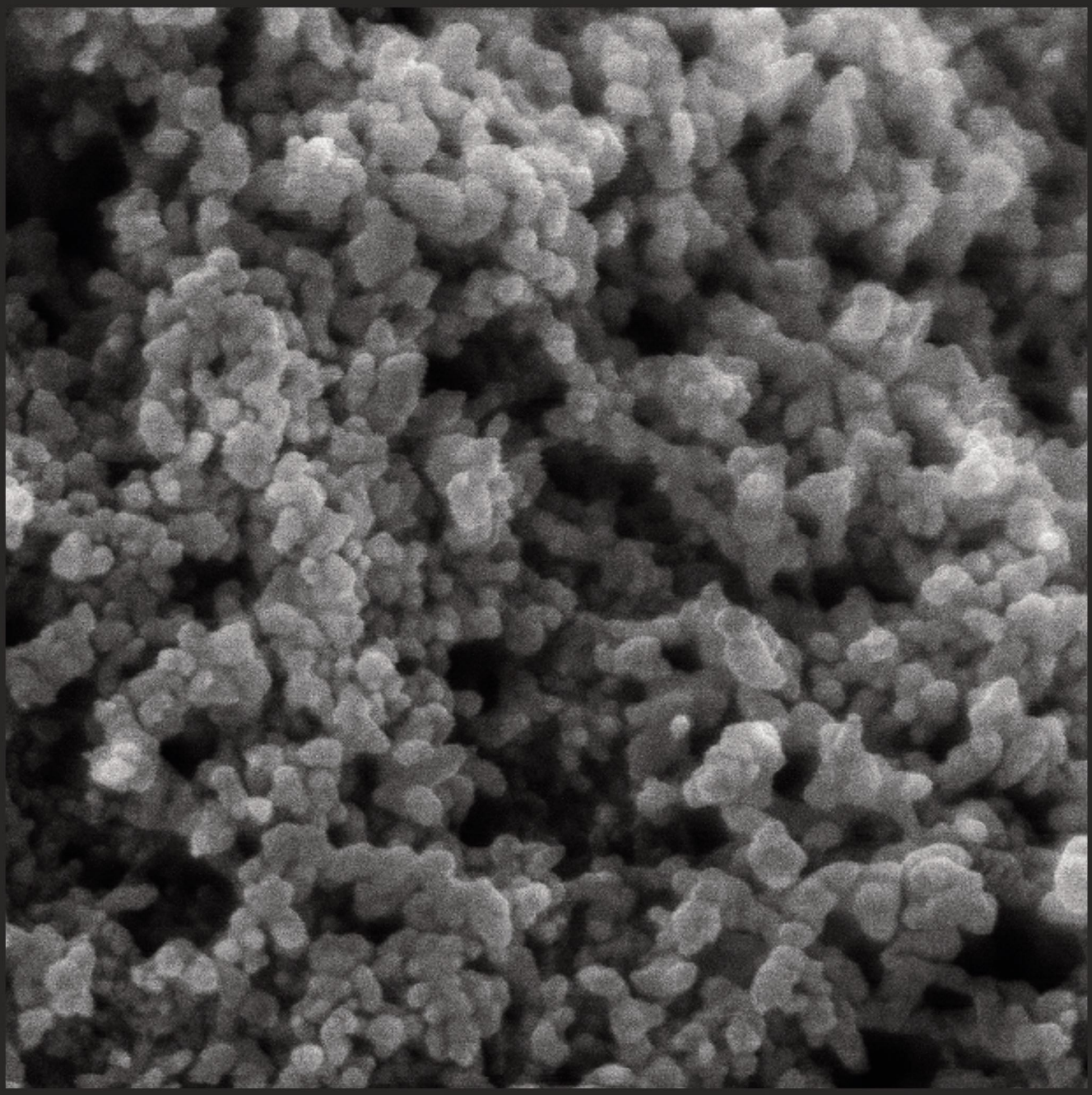
BULK STARCH

JIN SHOFU

2 μm

STARCH NANOPARTICLES

JIN SHOFU



Courtesy CSGI

AMA

Art Media Agency

WANT TO KEEP UP WITH THE ART WORLD NEWS?

There is an app. for that!

news.artmediaagency.com