For priceless European art, extra protection costs very little

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Credit: AI-generated image (disclaimer)

Inexpensive new materials and sensors will help even small museums prevent irreversible damage to objects.

Overlooking the waters of the Grand Canal in Venice, the former home of American art collector Peggy Guggenheim houses one of Italy's most

important collections of 20th century works. Until recently, many of them were at risk from an invisible attacker: acetic acid released by their aging wooden picture frames.

Chemists based in another renowned Italian city, Florence, have come up with a new material that will protect the artworks from acetic acid, formaldehyde and other damaging volatile organic compounds (VOCs) for between 50 and 100 years.

Clever and cheap

"We synthesized the first absorber for acetic acid and formaldehyde using a very clever, cheap method," said Piero Baglioni, professor of physical chemistry at the Center for Colloid and Surface Science, or CSGI, in the University of Florence.

The material is flexible and biodegradable and can absorb twice its weight in pollutants. It's made mainly from castor oil.

Curators at the Peggy Guggenheim Collection have applied sheets of it to the backs of paintings and on a wall in one room, which includes a 1929 painting by Vasily Kandinsky and a 1915 sculpture by Umberto Boccioni.

Levels of acetic acid in the room have since dropped from two parts per million (ppm), which is high enough to damage artwork, to safe levels of 0.5 ppm, according to Baglioni.

The material, Nanorestore VOCs, can be produced in any shape, size and color, said Baglioni, who coordinated a research project called APACHE that developed a range of products designed to protect valuable artworks.

The discovery is likely to have a major impact on the future health of

artworks, including those in storage. That's because many galleries and museums store their collections in wooden containers, which release VOCs.

The Pompidou Center in Paris—home to Europe's largest collection of modern and contemporary art—is testing the material for its storage containers. The museum keeps most of its 120,000 pieces in wooden crates, including works by Pablo Picasso, Amedeo Modigliani and Georges Braque.

Scream test

Baglioni is also testing the material in the Oslo, Norway-based museum dedicated to Edvard Munch and featuring one of the artist's most famous paintings—The Scream. Hundreds of Munch's prints and drawings are kept in wooden drawers that would cost a small fortune to change to a new material, according to Baglioni.

In February, following APACHE's end last year, his team put sheets of the material—costing about €5 each—in the storage drawers and will check the VOC levels in June.

"If it works, the museum will save a lot of money," Baglioni said.

The product will soon be on the market for museums and galleries. It's also being marketed as a way to purify the air in homes, hospitals and offices. VOCs comprise 80% of indoor air pollutants and can affect people's health.

Baglioni is working with researchers at Sweden's Chalmers University to produce what they hope will be the world's most effective and environmentally friendly material for absorbing VOCs.

APACHE also developed sensors that cost just €0.10 each to monitor levels of VOCs. These will be made by Goppion, an Italian company that produces display cases used by the Louvre and other cultural institutions.

But the company, which took part in the project, needs broader demand for production to be viable.

"If the market for this system is restricted to museums and galleries, it won't be profitable," said Baglioni. "So we have to find an additional use for them."

Invisible threats

Most threats to Europe's masterpieces and historical artifacts are invisible to the naked eye: changes in temperature or humidity, ultraviolet light, small vibrations from the footfall of visitors or building works as well as VOCs.

Even the type of building that the works are housed in—modern or old, stone or wooden—affects them. Often, the impacts become visible only once the damage is done.

Whereas large museums and art galleries can pay for multiple sensors to monitor closely their collections, cash-strapped smaller institutions struggle to meet international standards on maintenance and storage.

"It's really hard for small and medium-sized museums to preserve their artifacts because of a lack of expertise, human resources and means," said Marie-Dominique Bruni, program manager at the French Alternative Energies and Atomic Energy Commission, also known as CEA.

Bruni coordinated a project called SensMat that developed sensors and

software to monitor as many as 12 different environmental factors—from dust levels to vibrations—and alert conservators to the risks to art in their care so they can act before damage occurs.

"We facilitate the way they collect and interpret this data to decide the best way to display an exhibit, or what to change if its environment puts it at risk of damage," said Bruni.

That may mean changing the climate controls, limiting the number of visitors or moving the item to another room.

Metal objects, for example, can corrode in the wrong temperature, humidity and light conditions.

"When that corrosion becomes visible, it's too late," said Bruni. "So we have to move the objects or change the temperature and humidity to prevent their corrosion."

One of the most detrimental effects is low-frequency vibration. These could come not just from visitors' footfall and building works but also auto traffic.

"Museums need to diagnose the impact of vibrations," said Bruni. "Frescoes painted on walls or ceilings and objects made with different layers are particularly vulnerable."

Software success

Museums and galleries increasingly lend collections to each other, a practice that creates new challenges for the transport and display of objects.

"Museums and galleries have to guarantee they won't endanger the

objects they are receiving," said Bruni. "Our software could help them define the conditions needed before receiving new objects. Insurance companies are very interested in this kind of information."

SensMat, which ran from January 2019 through August 2022, worked with museums in seven European countries including Denmark, France, Germany and Italy.

"It was really important to have studies in different climates and different locations," said Bruni.

This meant being able to develop solutions suited to a wide range of scenarios. The SensMat team hopes its findings will be used to help update international recommendations on how to display and preserve objects.

Today Bruni is trying to find investors in order to complete the last stage of development and put the software on the market.

Large museums have expressed interest in the software, but making it affordable for small galleries is the ultimate goal.

"We've received lots of demand for the software," Bruni said. "We just need to develop it a little bit more. We are almost there."

More information:

- APACHE
- SensMat

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