

Surface Cleaning of Paintings and Polychrome Objects in Italy: The Last 15 Years

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ABSTRACT. The developments of cleaning methods for paintings in Italy during the past 15 years are described. Restoration in Italy has been mostly practiced by private restorers, whose limited budgets can hardly afford a good preliminary diagnostic campaign. Public laboratories, such as those that belong to Soprintendenze or museums, still represent a small minority compared to the total number of restorers. Research for less toxic materials and a more reasonable and cautious use of the traditional ones, as well as a concern for informing restorers, began during the 1990s. Since then, about 4,000 technicians have been trained, and a number of different training courses have taken place in Italy as well as in other countries. Not all the participants were converted to a rational approach based on the execution of solubility tests, followed by a layer-by-layer action to reach the highest selectivity, favoring aqueous methods whenever possible and using solvent-gelled processes rather than liquid ones to operate in the least invasive way. Nonetheless, a positive example of the increased sensitivity toward this methodological approach can be seen in the Restituzioni, an event that involves a series of restorations promoted by an important bank and that already has celebrated its 20th convocation. During the first years, a materials approach to the restoration of artifacts, such as canvases, panels, and painted sculptures, was more traditional, whereas after a decade, more and more interventions relied on the use of the solubility test, aqueous methods, gels, and other such approaches.

THE STARTING POINT

During the 1990s the awareness of methods and materials used for restoration in Italy was not very different from that of other European countries. To appreciate what little difference there was at that time, it is probably enough to compare the different reference texts on restoration used for training in Spain (Diaz Martos, 1974), France (Mâle, 1986), and, with some exceptions, Germany (Nicolaus, 1998).

At the time, the Italian literature on this subject was still not very precise or clear on how to approach cleaning during the treatment of a polychrome object. Even the most up-to-date texts of those years did not discuss this subject thoroughly. The most frequent suggestion given was to keep using the traditional methods that had been established mostly in Rome at the Istituto Centrale per il Restauro (Bon Valsassina, 1985; Bernini, 1988; Luciani, 1988). At best, the texts would offer suggestions on how to perform a good treatment, referring to a more specific bibliography (Perusini, 1989).

It cannot be ignored that quite often, Italian restorers would still find it difficult to step away from the precepts of old handbooks, such as that by Secco Suardo (1894), either in the original version or in its twentieth-century reprint edited by Gino Piva (1988). In 1989, a very important book that is still currently used for training in many

Italian Conservation Schools was published, *La Chimica del Restauro* (Matteini and Moles, 1989). It is a very useful tool that discusses many materials used in the creation of artifacts, together with the materials commonly used during conservation treatments. Among these, cleaning materials are presented from a chemical and physical point of view; the way they work is explained, and the issue of their toxicity is also discussed. At the time of its first publication, this book systemized the knowledge and the practice of restoration, including cleaning. However, the Teas triangle diagram of solvents was only briefly mentioned and was still represented in an imprecise way.

THE STATE OF THE ART

In the second half of the twentieth century, the cleaning of easel paintings and polychrome objects in Italy was mainly performed with neutral organic solvents and acid and alkaline reactants, sometimes mixed together and/or with water. One of the most commonly used mixtures was obtained by mixing water with an alkaline substance in variable proportions.

The practice of cleaning was mainly based on a set of formulas and recipes considered effective to solve some problems such as removal of varnishes and retouchings; everything was entrusted to the practical skills of the restorer and his or her experience. Testing was performed with mixtures of different solvents that were ready in the studio for use and were considered efficient enough to remove ingrained surface dust rather than varnishes, unknown coatings on paintings, old retouchings, and old fillings. As reported in Table 1, each of those mixtures usually had an acronym as a name, made up of a number (the number of substances in the mixture) and letters (referring to the first letter of each substance).

This was obviously the common practice in private studios, whereas museums and studios belonging to the Soprintendenze

could usually afford a good preliminary diagnostic campaign, which made it possible to avoid such empirical approaches. The Opificio delle Pietre Dure in Florence was the first institution to try and use a carrier or supporting material called a stearic emulsion, commonly known as *pappina fiorentina* (Matteini and Moles, 1984). This allowed a suspension of organic solvents and alkaline substances to be prepared in a very dense paste, thus avoiding their diffusion into the paint layers, and it proved to be much more efficient than the traditional methods relying on paper or cotton substrates.

Sometimes cellulose ethers were also employed as supporting materials for solvents. This was a common practice in cleaning frescos and stone artifacts, where a buffer mixture including a detergent and ethylenediaminetetraacetic acid (EDTA) in water, known as AB57, used carboxymethyl cellulose as the supporting material (Mora and Philippon, 1977; Colalucci, 1990).

Solvents with a high or medium level of toxicity were commonly used, e.g., butyl ammine, pyridine, carbon tetrachloride, and formic acid. It was also common practice to wash cleaned areas of the painting with liquid or gelled solvents. This operation was inappropriately called neutralization and was performed in order to eliminate any residue of the solvent or the acidic or alkaline substance previously employed during the cleaning process in order to halt its reaction. In practice, this practice only interfered with those solvents' evaporation time.

On the positive side, some very old methods, such as burning or regeneration of old varnishes, had gradually been abandoned. These methods were also quite risky for the health and safety of the restorer.

EARLY DEVELOPMENTS

The papers from the Brussels IIC Congress of 1990 (Mills and Smith, 1990) and other literature focusing on more updated

TABLE 1. Some common mixtures employed in restoration. Note that the acronyms stem from the Italian name of the solvents. DMF = dimethylformamide; n/a = not applicable.

Mixtures	Components	Ratio
2 A	water + ammonia	1:1
3 A	water + acetone + ethanol	1:1:1
4 A	water + ammonia + ethanol + acetone	1:1:1:1
AB	water + butylamine	1:1
ABD	water + butylamine + DMF	1:1:1
Benzine 80°C–100°C	Hydrocarbons	n/a
Nitro thinner	mixture of esters, ketones, alcohols, and aromatic hydrocarbons	variable, depending on the producer
DA	DMF + amyl acetate	1:1
DAN	DMF + amyl acetate + nitro thinner	1:1:1
DIDAX	DMF + synthetic thinner + xylol + acetone (35 + 15 + 10 + 10 mL, respectively)	3.5:1.5:1:1
Petroleum ether	Hydrocarbons	n/a
White spirit	Hydrocarbons	n/a

methods for cleaning paintings (Feller, 1972:9; Masschelein-Kleiner, 1991) only slowly gained acceptance in Italy, mainly because of the lack of an Italian translation for the papers. A good example would be the slow circulation that the Teas triangle diagram of solvents had in Italy in those years, although it had been employed in the conservation field as a starting point for solubility tests soon after its first inception in the 1960s.

At the time, the success of any conservation treatment was still pretty much delegated to the ability of the restorer to choose what to remove and what to keep on the painting in order to achieve a good result and restore its harmony and color balance. Sometimes this empirical approach was the reason that paintings exhibited blanching, salt formation on their surface as well as between original paint layers, dryness, and surface paint loss. Retouching and varnishing were considered a useful way to disguise these unwelcome effects.

The reasons why such risks were somehow considered impossible to avoid were briefly as follows:

- Any painting, after its treatment, had to look different from how it had looked before.
- A treatment had to be time efficient in order for the restorer to make the most of his or her time for both practical and economical reasons.
- Selectivity was not considered as any mixture of solvents was prepared with the aim of being as widely effective as possible.

These traditions from the past kept influencing restorers in Italy for a long time, even years after new solutions had been found. In fact, the literature in Italy also had already warned against those risks and suggested that caution be used with any solvent and that a painting could not always be transformed by cleaning. A layer by layer cleaning was always to be preferred.

A good example would be an excerpt from the essay *Breves Observaciones* by Poleró and Toledo (1868; published in Italian in 2010), who criticized excessive cleaning followed by excessive retouching, thus creating a painting sometimes completely different from the one intended by its creator. He stated (my translation), “An adequate cleaning is performed after reasoning on every single painting, in order to make the most of its beauty and enjoy the harmony of the color balance . . . finally to distinguish and recognize the hand of the original master.”

THE TOXICITY ISSUE

Very similar behavior permeated the discussion on toxicity: a “good” restorer would know how long to use a toxic solvent and when to stop using it, without being affected by its use in any way. It was obviously not generally known for how long these toxic substances could remain in the environment and circulate within the human body, even after their use had been stopped or discontinued. At the time, no epidemiological analyses were carried out in this field that would have made these points clearer.

An ideal situation would have been a studio with good ventilation that also had a good extraction system, where the use of a toxic solvent, if safe for the object, could be controlled. Unfortunately, in private studios, the only protective items used, if any, were gloves and masks. Quite often, the situation was pretty much the same for studios belonging to institutions.

Toxicity eventually became a great concern in the 1990s, and it was the main reason for initiating the information campaign on new methods and techniques both in conservation schools and among restorers and conservators (Pietropolli, 2001). Thus, the search for less toxic materials and a more reasonable and cautious use of traditional ones (such as diethanolamine and hydrocarbons) were undertaken and are currently ongoing (Cremonesi et al., 2008; Cremonesi, 2009).

CLEANING

Quoting Secco Suardo (1894, reprinted 1988:317–318), “Let’s listen to the history, let’s talk with those men of art, and we will need to admit that more than time and more than wars and more than fires and iconoclasts, what really destroyed lots and lots of paintings is the ignorance of people pretending to clean them.” There are similar words in many texts from the past. In individual small-sized enterprises, whose limited budgets can hardly afford a good preliminary diagnostic campaign, it is of fundamental importance to know tests and methods that every conservator can easily put into practice, for instance, the Feller solubility test, the Triansol software for calculating the solubility parameters a certain mixture of solvents (Bortolotti and Cremonesi, 1999), a newly proposed solubility test in Cremonesi and Signorini (2004), and so on.

OFFERING PROFESSIONAL DEVELOPMENT

Promoted by Paolo Cremonesi since 1995 and then by Cesmar7, the campaign to disseminate information on less toxic materials and more cautious techniques of cleaning paintings has involved so far about 4,000 restorers in Italy and hundreds in other countries. Training courses are both theoretical and practical and are usually organized as a basic course followed by an advanced one; both courses are usually taught by a chemist and a conservator. The same training is currently given in some conservation schools in Italy, whereas in other schools special workshops are given on these subjects.

The first time this updating campaign was presented in an international context was during the First International Congress “Colore e Conservazione” (Cremonesi, 2003a), held in Pizzola sul Brenta, near Padua, and organized by the Cesmar7 in 2002. At the same time, three workshops were organized by Cesmar7 and taught by Richard Wolbers to update cleaning methods and stimulate research, for example, on agar gels (Campani et al., 2007; Anzani et al., 2008), the use of cyclododecane as a

temporary protective coating in cleaning paintings (Hiby, 2008; Riggiardi, 2010), and water-based solutions for cleaning wax objects (Berzioli et al., 2010). Further workshops are currently in progress.

The restoration historian Bonsanti (2006:27) also has been involved in this movement, stating

I have been following this campaign quite closely, and I am impressed by how quickly the new methods and materials spread among conservators and restorers . . . I am not saying that everybody in Italy is now converted to this rational approach, there are still difficulties sometimes in leaving the old habits and adopting the new proposed methods, mainly due to some inertia and technical difficulties found by some of the people operating in this field.

It is necessary to specify the following attitudes and actions among the people involved:

- Not everyone welcomed these new methods or was converted to this new approach.
- Some restorers decided to adopt only some of the solvents and recipes suggested.
- Others found it especially difficult to use water-based methods.

THE MOST SIGNIFICANT PROPOSALS

The main elements of this new approach are as follows:

- A rational and reasoned approach to cleaning should be used. Cleaning must be performed only after careful observation of the object that needs treatment and must be focused on solving any specific problems noticed. “The painting [is] a starting point,” as Wishwa Raj Mehra (retired from Central Research Laboratory for Objects of Art and Sciences, Amsterdam, personal communication) has said.
- Tests should be used for water-based methods as well for solvent-based cleaning.
- Selectivity in choosing materials for cleaning as well as in using them is important. When possible, using gelled solvents rather than solvents in liquid form is suggested.
- The evaporation time of each solvent should be observed; the common practice of “washing” treated areas after cleaning should be avoided.
- Alternatives to toxic solvents and/or mixtures of solvents are preferred.

Some examples can be given. When this campaign first started, the high toxicity level of nitro diluents (a mixture of organic solvents, mainly toluene, acetone, dichloropropane, butyl cellosolve, isobutyl acetate, and isopropyl or isobutyl alcohol, in varying proportions depending on the dealer) and of butyl amine was clearly recognized. Dimethyl sulfoxide (DMSO),

dimethylformamide (DMF), and *n*-methylpyrrolidone were suggested instead because they are polar aprotic solvents with similar characteristics and solubility ability (Cremonesi, 2004). Concerns about their use came from their long retention time inside the paint layers and their very poor selectivity. These reasons were why employing them only if necessary was also suggested, with mixtures with more volatile solvents and/or in a gel preferred.

However, as a result of these suggestions, DMSO was soon adopted by many conservators and restorers as the “universal solvent” because of its capacity to quickly dissolve old varnishes and oil retouches as well as its lower toxicity. Alternatives to DMSO, even when possible, were not even considered, despite the fact that the use of dipentene, the racemic limonene, also had been suggested as a low- to medium-polarity solvent ($f_d = 75, f_p = 20$, where f_d and f_p are the Teas parameters characterizing the relative polar dispersion strength and hydrogen bonding, respectively) to replace some of the more toxic aromatic or chlorinated hydrocarbons or turpentine essence. Dipentene was considered a low-toxicity solvent, often found in soaps and other everyday products. However, further research and practical tests showed the risk of its polymerization: samples kept in jars far from daylight turned into an orange, very viscous liquid. In addition, its low volatility and long retention time in the painting layers led to curtailment of its use, and restorers were warned not to use it anymore.

DISCOVERING WATER

With the goal of finding alternatives to the well-known and commonly accepted use of toxic solvents the most innovative solution regarded water-based cleaning methods already proposed at the start of the campaign. Following Wolbers’s (2000) footsteps, the elaboration of some current Italian methodologies that focused on the effectiveness and selectivity of new materials began. These methodologies were considered a great tool for education about a layer-by-layer approach to cleaning so as to reach a high selectivity. This subject will be only briefly discussed since it has been discussed in detail in previous international contexts. For example, in the nineteenth century some texts, e.g., Pietro Edwards (see Tiozzo, 2000), Forni (1866), Secco Suardo (1894), and Poleró y Toledo (1868), had already mentioned the use of water for cleaning paintings (Perusini, 2010). These texts mainly suggested the use of common water for surface cleaning, followed by varnish removal if necessary.

Much has been learned since that time, and the chemical and physical characteristics of water, its power, and the associated risks are better understood. The pH values compatible with painting materials and the addition of chelating agents, soaps, and enzymes in order to reach a certain result (Cremonesi, 2003b) are also better understood.

Many conservators welcomed the use of water-based methods in their private studios, despite the greater complexity in preparation and use, and are now aware of the importance of a careful cleaning performed to remove what is on the varnish and

not the varnish itself. Whether or not to remove old varnishes and overpaint layers is a critical choice that cannot be left in the hands of a conservator alone. Respecting the painting in its history and materials should always be the aim of any conservator and curator.

Chelating agents, such as EDTA salts, were already known and employed in the restoration of frescos and stone artifacts. For paintings, the alternative use of a weaker chelating agent, such as citric acid salts, was suggested. Because of their disaggregating ability, chelating agents should always be used in low concentrations (less than 1%), as has been always recommended. However, some restorers preferred to use them in higher concentrations, even up to 20%, thus causing damage to the pictorial layers.

Gels were suggested to thicken water-based solutions, but with the caveat that this practice would need to be carefully avoided on particularly damaged paint layers. It is now possible to choose among different gelling materials with different characteristics and specificities, whereas in the past there was no specific knowledge about any of them, except for the above-mentioned carboxymethyl cellulose in the AB57 mixture and some paint strippers. On the other hand, it was quite common for conservators and restorers to use various weight paper, cotton, cellulose pulp, clays, and stearic emulsion.

BETWEEN TRADITION AND INNOVATION: ONE EXAMPLE

A positive example of the increased sensitivity toward this methodological approach is the Restituzioni (Restitutions), a periodic and very relevant event. In 1989 an Italian bank started the Restituzioni to promote conservation treatments of objects, and now it has had its 14th meeting.

The work carried out by prestigious institutions such as the Opificio delle Pietre Dure and the Istituto Centrale per il Restauro is not as significant for this discussion since their conservation choices, i.e., which objects to treat and how to treat them, would not reflect choices made in the private sector. That is why Cesmar7 activities are better reflected in the Restituzioni. A catalog has been published for each of the 14 years of the Restituzioni, each one containing reports of the objects treated each year (Rigon, 1989–2000; Bertelli, 2002–2008).

For this study 164 reports have been analyzed: 101 on paintings, 37 on panels, 15 on polychrome objects on inorganic support, and 11 on painted wooden objects. All the studied works are artifacts of great importance by artists such as Bassano, Tintoretto, Veronese, Ribera, Vivarini, Palma, Luca Giordano, Tiepolo, Carpaccio, Lotto, Titian, and Pinturicchio.

Even now, reports are still being written by curators and art historians. Initially, these reports tended to emphasize the historical aspects of the objects and their conservation treatments without providing any specific detail on the technical aspects. Generally, there was no mention of the materials involved and those used for specific treatments, and quite often, cleaning was

just mentioned and not discussed at all. For instance, cleaning would be described as “gradual and differentiated cleaning” or “delicate cleaning.” Solvents were commonly quoted as “adequate,” “appropriate,” or “convenient” and were generally classified as “weak organic solvents.” Solubility tests were commonly referred to as cleaning tests with the well-known old mixtures mentioned and mainly involved high-polarity solvents; the use of toxic solvents was accepted and not disguised. Except for one single initiative of the Galleria d’Arte Moderna in Milan carried out over the past two years, so far there have been no systematic studies on all the treatment reports stored in museums and Soprintendenze.

In 1996, things started to change. In that year’s Restituzioni catalogue (Rigon, 1996) a new attitude was evident. For the first time new materials were mentioned, such as artificial saliva, buffer solutions, water-based solutions, solvent gels, resin soaps, the Feller test, the new solubility test with LA-LE-AE (ligroin-acetone, ligroin-ethanol, acetone-ethanol), and so on.

Ten years later, Bonsanti, in the introduction of 2006 Restituzioni catalog, made a point about the positive diffusion of the new proposed methodologies and techniques, now commonly used in private studios as well as in those studios belonging to public institutions. At the same time, he admitted that old habits and techniques still existed in some places, proudly employed by renowned conservators and too often allowed by curators in charge of the conservation and protection of those works of art. It is clearly evident that an evolution, in both materials and techniques, is now in progress; it is not surprising, however, that this process is far from being completed. This increased sensibility toward a methodological approach is an integral part of a conservator’s professional development.

CONCLUSIONS

The methodologies and techniques discussed here mainly apply to old artifacts and original historical materials. Further research is required in this field, and less invasive cleaning methods hopefully will be developed. More studies are necessary, especially for the field of contemporary art. The use of other methods, such as rubbers, needs to be evaluated, including the risks related to their use and the possible interactions they may have with other materials.

A field to explore is that of physics-based methods for cleaning. Research is the keyword, both for prevention and for conservation. There is plenty to be done by all professionals involved in various ways in the conservation field. This is why the conservation-restoration profession still has a fundamental meaning and many prospects and possibilities ahead.

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Italy in Early 1400s. series of states: Papal States around Rome, Republic of Florence in Tuscany, Venice in North, Naples in South. Florence. Arno River running through it providing clean drinking water upstream, power source for mills next to city, sewage downstream 30,000 people at the time oligarchy: near democracy, ruled by council of 10 elected by the wealthy raised above swampy ground cities get dense as they grow: can't expand because don't want to be outside of the city walls great art. Michelozzo di Barolomo 1446 Florence, Italy palazzo= large townhouse in Italian, not... The developments of cleaning methods for paintings in Italy during the past 15 years are described. Restoration in Italy has been mostly practiced by private restorers, whose limited bud-gets can hardly afford a good preliminary diagnostic campaign. Public laboratories, such as those that belong to Soprintendenze or museums, still represent a small minority compared to the total number of restorers. At the time, the Italian literature on this subject was still not very precise or clear on how to approach cleaning during the treatment of a polychrome object. Even the most up-to-date texts of those years did not discuss this subject thoroughly. Painting on a surface is not same for all surface types. Some precautions are to be taken before and after painting. Methods and process of painting on different surfaces are discussed. Finishing is the last coat applied on surface which is generally applied on the under coatings. It should be applied in smooth, uniform manner. It decides the whole final look of surface, so, skilled workers is required for better results. That time, 40 years ago, was the last time that the painting has been repaired. Since then, the painting has become dirtier. It has gotten a slightly cloudy coating on it that makes it hard to see the painting's true colors. That's why the museum is going to "restore" it "to clean it and try and make it look like it did back when Rembrandt first painted it. The museum expects the whole project will take a few years. They don't even plan to start cleaning until next July. Until then, experts will study the painting and plan how they will restore it. (Source: Photo: Daniel Maissan, Rijksmuseum.nl.) Working on such a famous and important painting is a job that can't be done quickly. The museum expects the whole project will take a few years. They don't even plan to start on it until next July. B Egyptian Paintings. More than 5 000 years ago, the Egyptians began painting the world around them on the walls of the Pharaohs' tombs. The Egyptians believed there was life after death, so they painted pictures of mythological stories and of daily life. The Renaissance is usually defined as the rebirth of painting and literature inspired by classical models, especially those of ancient Greece. The Renaissance lasted from the 15th to the 16th century and its centre was Italy. The great artists of the period, who include Michelangelo, Leonardo and Botticelli, were able to paint nature and people with great accuracy. This painting shows Monet's interest in analyzing tone and colour and, above all, the way light reflects on the surface of objects.