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Comparative Study of Washing Treatments for Pastel Drawings

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Abstract: A treatment procedure for pastel drawings developed at the Portuguese Institute of Museums and Conservation (IMC), consisting of alkaline blotter washing in a humidifying chamber, is compared with three other methods described in the literature. These include immersion in cold water, a combination of water mist and suction table treatment and ultrasonic mist in combination with a dry blotter support. The four treatments were applied to non-aged and aged test samples consisting of three types of paper and four pastel sticks, totalling 120 samples. Effects caused by the afore mentioned treatment methods were evaluated using six semi-quantitative parameters determined by visual observation (i.e. lateral pigment movement, paper staining, pigment loss, decrease in colour intensity, darkening and change of hue), as well as three semi-quantitative parameters obtained through optical microscopy and scanning electron microscopy (pigment agglomeration, compacting and penetration into the paper support). The results showed that the IMC method is not suitable for treating pastel drawings executed on papers with low porosity, but, of all tested methods, it is the most advantageous technique for treating pastel drawings executed on velour paper – the prevalent type of carrier for pastel drawings treated over the years at IMC.

Zusammenfassung/résumé at end of article

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1. Introduction

Pastel drawings are by nature extraordinarily fragile pieces of art (Moroz 1997). However, much like other artworks on paper, they may develop local or overall staining through adverse ambient environments, adverse framing conditions, or accidents. For pastels that had become disturbingly discoloured, an aqueous treatment may be considered. However, it is extremely difficult to carry out such an invasive treatment because the powdery pigments are only lightly adhered to the paper support (Corrigan 1997, Saunders 1999, Weidner and Zachary 1994). The weak adhesion is a consequence of low concentrations of binding medium used in pastel sticks, which is also responsible for the velvety nature of pastel drawings or paintings.

Pastel sticks are essentially composed of three components: the pigment, the extender and the binding agent (Burns 2002, Corrigan 1997, Moroz 1997). Pigments are generally the same as those used in tempera paints (Moroz 1997) and are mixed with an extender to add softness; typically kaolin or gypsum (Kosek 1998) can be

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found in pastels, although other white pigments are also used (Townsend 1998). The most common binder is gum, namely gum tragacanth or gum arabic, but other binders, such as animal glue, olive or linseed oils may also be employed (Kosek 1998). The binder concentration must not be too high or too low in order to prevent that the stick becomes too rigid or crumbly (Daniels 1998).

Aqueous cleaning treatments of pastel drawings were more frequently done in the past (Plenderleith 1956). Float washing and water immersion are traditional aqueous treatment methods for pastels (Kosek 1990). The risk of pigment migration or loss caused by contact with free water inspired the search for alternative treatment methods. The first and most important development in this respect was the introduction of the suction table in the 1970s (Weidner 1974); the exerted pressure minimized any lateral pigment movement. This method was later coupled with a moisture chamber equipped with an ultrasonic humidifier and an air filter system. Ultrasonic humidification is based on the generation of small water droplets that are applied using misting equipment. This allowed control over the amount of water and the direction of its movement through the drawings surface. Only a minimum amount of moisture was necessary to accomplish results that compared well to those achieved by more invasive washing methods such as float washing commonly used for more stable artworks. The cleaning is based on diffusion mechanisms (Weidner 1993, Weidner and Zachary 1994). However, the suction table washing treatment was later perceived more critically because of its tendency to draw pigments from the surface of the paper or textile support into its interior (Kosek 1990). Blotter washing combined with ultrasonic mist in a humidification chamber constitutes yet another alternative to float washing which was recommended for the treatment of friable and water-sensitive works (Albro et al. 1990, Keyes 1994). The use of this technique was more controllable and less cumbersome than the Weidner/Zachary suction table system. However, the traditional immersion method continued to be recommended even after the appearance of these alternative treatment methods (Moroz 1997). Summarizing, it seems that all methods can be problematic, as it has been shown in a comparative study of three pastel treatment methods including immersion, humidification and suction (Daniels 1998).

The main alterations of pastel media resulting from aqueous treatment that are reported in the literature are lateral dislocation of pigments, their penetration into the support, their dispersion in the water bath; further colour changes and the agglomeration or compacting of pigments (Kosek 1990, Weidner and Zachary 1994, Daniels 1998). Treatments including ultrasonic mist seem to cause fewer adverse effects (Daniels 1998), although pigment agglomeration and compacting may occur.

At the Instituto dos Museus e da Conservação (IMC, the Portuguese Institute of Museums and Conservation), a pastel washing treatment based on ultrasonic misting has been in use since 1992, although the method was published much later (Figueira et al. 2005). It was successfully used in the treatment of pastel paintings on velour paper [1] by the 19th-century Portuguese artist José Malhoa. These works had developed foxing stains shortly after being removed from their original glass enclosure (Figueira and Fontes 1998) and were to be permanently rehoused in this original enclosure. For this reason, it was thought important to clean the stained pastels by aqueous treatment and raise the pH of their paper supports as it is known that air-tight enclosures enhance the degradation of acidic papers (Havermans 1999). Although the aqueous treatment method was given positive evaluations in some unpublished studies at IMC using naked eye and stereomicroscope observation of test samples, other studies have shown that alterations can occur in the pastel surface morphology, which may not be detected with these methods (Daniels 1998). This present comparative study of several washing treatments is centred on more objective, precise and sensitive evaluation approaches.

The pastel drawing samples were treated with three methods employed in the previous study by Daniels (1998) and the IMC method. Alterations of the media that occurred as a consequence of the treatments were monitored and analysed through visual observation, photography, stereomicroscopy, optical microscopy and scanning electron microscopy (SEM). The study design closely followed the one by Daniels (1988) in regard to the use of sample preparation, treatment choices and comparison of their results. However, some aspects of sample composition and treatment methods differ from Daniels' experiment. Also, we complemented Daniels qualitative evaluation by a semi-quantitative evaluation.

2. Experimental

2.1 Preparation of test drawings

120 samples were prepared using four different pastel sticks on three different types of paper commonly used for pastel drawings. The papers were chosen for their different textures: a modern velour paper, the most porous and most textured of all paper samples; an Arches Aquarelle paper, the least porous and moderately textured; and a black Canson drawing paper, of moderate porosity and smooth texture. Some of the papers' properties, according to information provided by the manufacturers or determined in our laboratory, are reported in Table 1. Although the composition of modern velour paper differs substantially from its 19th-century precursor, its textural surface characteristics were felt to match those of the early velour papers more closely than the filter paper used by Daniels.

Table 1: Properties of the papers used

Material description	Arches Aquarelle paper	Canson Mi-Teintes black paper	Modern pastel velour paper
fibre composition	100% cotton	50% cotton	synthetic flocked fibres adhered to a lignin containing paper.
sizing	gelatine	gelatine	—
thickness	0.54 mm	0.27 mm	0.44 mm
texture	mild textured	low textured	highly textured
water absorbency*	no changes after 45 minutes	the drop was absorbed after 20 minutes	the drop was absorbed immediately

* the test was carried out with a water drop of approximately 6 mm in diameter.

Table 2: Suppliers and composition of pastels used

Material description	Black pastel	White pastel	Blue pastel	Red pastel
brand	Winsor & Newton	Winsor & Newton	Winsor & Newton	Talens-Rembrandt
commercial name	charcoal grey 142	zinc white 748	cobalt blue hue 179 (tint 4)	permanent red deep 371,5
pigment	iron oxide	zinc oxide	phthalocyanine blue and synthetic ultramarine blue	pyrrole red and pyrrole rubine
pigment chemical composition	magnetite and hematite	zinc oxide	copper phthalo-cyanine and sodium aluminium silicate with sulphur compounds	diketopyrrolo pyrrole and diketo-pyrrolo pyrrole
extender	barium sulphate and calcium carbonate	barium sulphate and calcium carbonate	barium sulphate and calcium carbonate	kaolin, barium sulphate and calcium carbonate
binder	gum tragacanth	gum tragacanth	gum tragacanth	—

The black, white, blue and red pastel sticks were selected from two different brands. They are identified in Table 2, which lists some of their properties according to the information provided by manufacturers or experimentally determined in

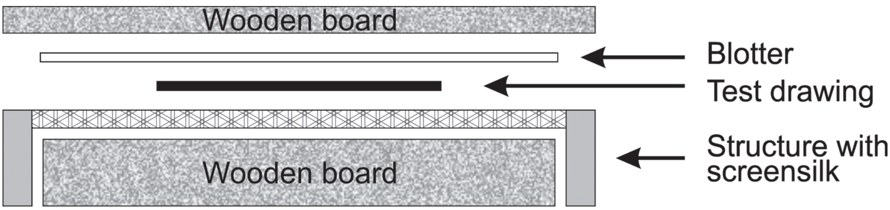

Fig. 1: Device used for the drying of the test drawings.

this study. Some of the pastels were chosen based on the known tendency of certain pigments to be adversely affected by exposure to water: iron oxide, for example, can turn darker (Weidner and Zachary 1994) and easily creates clumps (Daniels 1998); zinc oxide can change into zinc carbonate (Eastaugh et al. 2005); and synthetic ultramarine blue may turn darker and may compact (Daniels 1998).

The manufacturers' information on the pastels' composition was confirmed by micro X-ray fluorescence spectrometry, micro Fourier transform infrared spectroscopy and micro Raman spectroscopy, which identified both the colour providing pigments as well as those used as extenders. The papers were cut into pieces of 10 cm by 10 cm and the pastel sticks were applied manually, exerting the same pressure, repeating the same drawing motif. Only one colour was applied to each paper sample, which yielded 12 samples for each combination of paper and pastel. The paper samples totalled 120 specimens including both the artificially aged and non-aged samples that underwent 4 different treatments and their respective reference samples.

Half of the samples (60) were submitted to the four washing methods without further treatment, as in Daniels study. The other half of the test drawings (60) was submitted to a natural "fixation" process to enhance the pigment-paper bond which was followed by artificial ageing. The fixation process was carried out by first exposing the test drawings to an atmosphere of 80–90% RH for a period of 10–15 minutes; subsequently, the samples were placed directly onto a smooth screen printing polyester mesh (T120) face down, topped by a polyester non woven fabric, a dry blotter and a wooden board (Fig. 1). No further weight was placed on top. The blotter was replaced after 20 minutes and then was replaced daily for the duration of one week. This two-step process, which will be referred to as "fixation process" in the following, increases the contact of the pigment particles with the support and causes a better adhesion. The use of steam as a fixative by artists has been reported in literature (Daniels 1998). These sixty drawings were then subjected to artificial ageing for 24 days at 65% RH and 80°C, according to ISO 9706:1994(F), in a FITOCLIMA 150 FDTU chamber.

2.2 Treatment of the samples

Ninety-six test drawings, both non-aged and artificially aged, were treated using the following four methods: 1) immersion in distilled water for one hour with no agitation; 2) suction and water spraying the surface using a suction table; 3) exposure to ultrasonic mist for 1 or 4 hours over a dry blotter. All three methods were executed according to Daniels experiments and samples were afterwards allowed to air dry (Daniels 1998). The IMC method has some similarities with the ultrasonic mist method used by Daniels, but differs in the following: the drawings are in contact with a blotter (pH ≈8) soaked with a dilute solution of calcium hydroxide instead of a dry blotter, and the drying process proceeds under slight weight (Figueira et al. 2005).

The three methods used by Daniels were slightly altered: 1) suction table treatment was increased to four hours because it was felt that treatment efficiency would more closely resemble the immersion method, where papers samples are in contact with water much longer (Daniels 2002); 2) for the same reason, the ultrasonic mist method was applied only for a four hour period instead of one and four hours; 3) the test drawings were flattened using the "fixation process" (Fig. 1) after air drying, in order to make them more comparable to the IMC method. The washing procedures are described in the following, the IMC method being explained in more detail:

2.2.1 IMC washing method

The IMC washing method includes five steps:

- Step 1: a dry blotter is soaked in a calcium hydroxide solution (pH 9) for 20 minutes. Meanwhile, the test drawings are placed in a humidification chamber and exposed to ultrasonic mist in order to relaxe them. The humidification chamber is equipped with closable openings to enable handling during humidification.
- Step 2: the moistened test drawings are temporarily removed from the chamber in order to place the wet blotter inside. When lifted from the calcium hydroxide solution, the blotter had a pH of 8. The samples are then placed on top of the blotter. If needed, the test drawings are further moistened by spraying water on their back side.
- Step 3: samples and blotters are exposed to mist in an atmosphere of 95% RH for four hours (with real drawings the blotters are changed when discoloured).
- Step 4: the test drawings are left overnight inside the humidity chamber on clean wet blotters (pH 8) without further humidification. The openings of the humification chamber are left half opened.

- Step 5: the test drawings are dried under controlled conditions: they are placed face down onto a T120 polyester mesh with no interleaving material, covered with a polyester non-woven material and a dry blotter and weighed down lightly with a wooden board with no additional pressure (Fig.1). The blotter is changed frequently until the back of the test drawings feels dry. The boards, measuring 50 cm × 70 cm each, are then weighed down with an additional 15 kg. The blotters are changed daily for at least one week.

2.2.2 Ultrasonic misting

Inside a humidity chamber, a relative humidity of 95% is created using a Honeywell ultrasonic humidifier. The test drawings are placed on dry blotter paper inside the chamber. They are removed after four hours and are allowed to air dry. They are then flattened according to Step 5 of the “fixation process”.

2.2.3 Immersion washing

The test drawings are immersed in distilled water for one hour, with no agitation and are allowed to air dry. They are then flattened according to Step 5 of the “fixation process”.

2.2.4 Suction table treatment combined with water spraying

This treatment is performed on a Mayline suction table operating at a pressure of 40 mbar. The test drawings, supported by blotter paper, are placed on the perforated surface of the suction table, then suction is turned on and water is sprayed using a Dahlia spray at a distance of 60 cm until the surface is glossy wet. Spraying continues when the water has penetrated the paper and the paper surface has lost its wet gloss. The process is repeated intermittently for four hours, then the test drawings are allowed to air dry. Finally, the drawings are flattened according to Step 5 of the “fixation process”.

2.3 Treatment evaluation methods

The treated samples were compared to non-treated reference samples. The following parameters were observed:

- Lateral pigment dislocation: pigment particles migrated from their original location and settled in a different place, only slightly adhering to the support without penetrating the paper fibres; apart from these pigment particles, no other staining of the paper could be observed.

- Paper staining: coloured compounds of pastels (ex. a dye) spread out laterally; the paper was stained, but pigment particles were not observed.
- Pigment loss: pigment was lifted and dispersed in water.
- Pigment agglomeration: pastel layer formed clumps.
- Pigment compacting: pastel layer was flattened.
- Pigment particles migrated from elevated parts of the support surface and settled in its recesses.
- Loss of colour intensity as result of pigment dislocation, loss or sinking.
- Darkening of colour.
- Alteration of hue; alteration of colour tonality.

Samples were assessed according to each parameter by visual observation with the naked eye or aided by the stereomicroscope or optical microscope; in some cases a scanning electron microscope (SEM) was employed. A scale from 0 to 5 was used that would allow semi-quantitative evaluation:

0 = not detectable
1 = very mild
2 = mild
3 = moderate
4 = severe
5 = very severe.

To support visual observation, drawings were documented with a digital camera (Nikon Coolpix 8700). Observation under the microscope involved two setups: the test drawings were observed under a stereo microscope (Leica MZ6 with a Leica camera DC 200, at 40x magnification) and under an optical microscope (Leitz-Dialux 20 with a Leica camera DC 500, at 110x magnification), which required small samples to be taken from the test drawings. Samples were also examined by means of an scanning electron microscope (SEM) type JEOL JSM-T330A (20 kV, 0.1 mA) at 150x and 500x magnifications. For SEM imaging the samples were coated with gold. Colour changes were evaluated only through visual observation, because pastel particles only partially cover the paper surface, and the colour of the paper influenced the instrumental measurement, giving incorrect values for the pigment colour.

All test samples were observed in a stereomicroscope, while SEM analysis was only carried out on velour paper test drawings due to limitations in time. Under the stereo-

Fig. 2: Drops formed during ultrasonic mist treatment on Arches Aquarelle paper.

microscope, pigment compacting or agglomeration could not be observed on velour papers, and no pigment penetration in Arches Aquarelle and Canson papers was noticed because of the different paper surface morphologies. The porous surface of velour paper and its structure renders pigment penetration easily visible, but blurs morphological changes of the pigment layer; Arches Aquarelle and Canson papers on the other hand have less porous surfaces which make the penetration of particles hard to observe, while morphological changes are clearly detectable.

3. Results and discussion

3.1 General assessment

The ultrasonic mist technique and the IMC method led to the formation of water droplets on the surface of Arches Aquarelle and Canson black papers, which is due to the low water absorbency of these test papers (Fig. 2); consequently those treatments were discontinued, as would happen in a real-life situation, and no further data was obtained for those cases. The problem was probably caused by the paper's low permeability (Table 1) which leads to the recommendation that these two treatments should not be used for papers with low water absorbency.

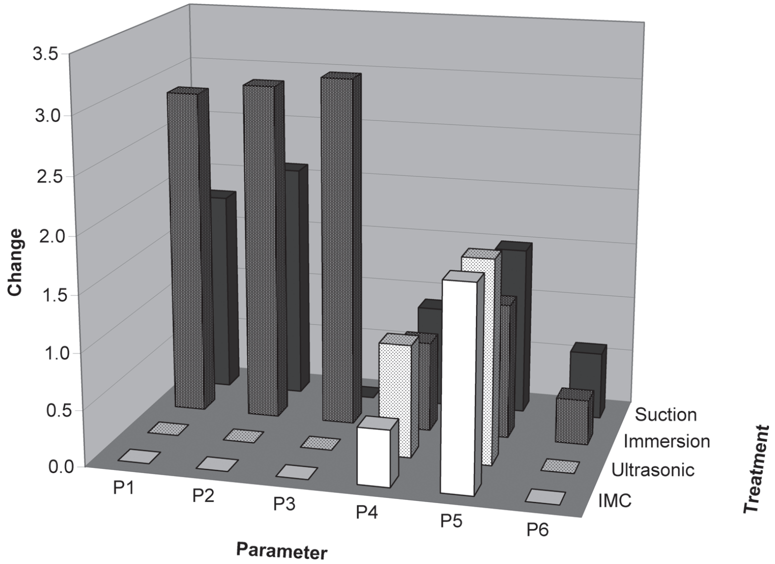

Fig. 3: Changes detected visually in non-aged samples;
parameters: P1 = lateral pigment movement; P2 = paper staining; P3 = pigment loss; P4 = loss of colour intensity; P5 = darkening; P6 = changes in hue;
each parameter was determined from 4 test drawings (IMC and ultrasonic mist methods) or 12 test drawings (immersion and suction table methods).

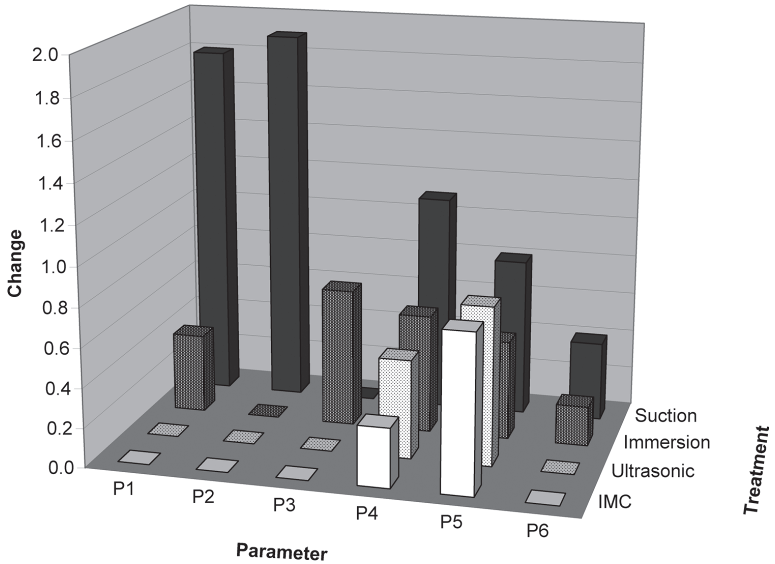

Fig. 4: Changes detected visually in aged samples; parameters: see Fig. 3.

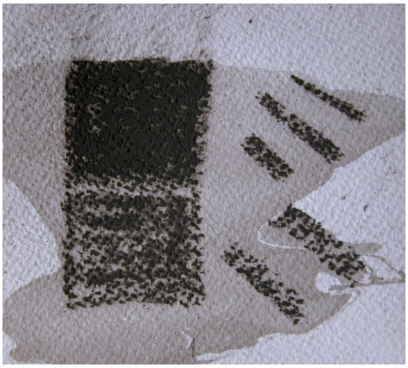

Fig. 5: Paper staining in the non-aged Arches Aquarelle drawing after immersion treatment.

In general, changes were more visible in non-aged than in aged drawings. Those differences were more pronounced in the properties related to the mechanical behaviour of pigment particles and their bonding with the paper support (lateral pigment movement, pigment loss, pigment penetration and paper staining) and less pronounced in the properties related to colour (hue changes and loss of colour intensity). The loss of colour intensity may be due to pigment penetration, pigment loss or lightening of colour (Figs 3 and 4). The fact that changes are less visible in aged drawings could be partially explained by decreased solubility of gums upon aging, a well known phenomenon that is caused by an irreversible loss of water, aggregation of polymer chains and cross-linking between gum molecules, a reaction that can be accelerated by some polyvalent metal constituents of pigments (Daniels 1995). However, it is unlikely that this is the main cause for the general decrease of changes with aging, since this phenomenon was also observed in the pastel drawings made with a red pigment which, according to the manufacturer, contains no binder. Thus, an alternative explanation might be increased pigment caking, which can occur upon ageing (Daniels 1998).

In general, immersion and suction table treatments caused more visible changes in drawings (Table 3), including pigment movement, paper staining (Fig. 5), pigment penetration, pigment loss and hue changes (Figs 3 and 4). This phenomenon was observed in all sets of papers including velour paper (Table 3) – the only paper treated with all four methods.

The changes caused by the IMC and the ultrasonic mist methods were less visible and mainly related to loss of colour intensity and darkening. These two effects depend little on the treatment method, being similar for all four treatments (Figs 3 and 4).

IMC and the ultrasonic mist treatment were not performed on samples made of Arches Aquarelle and Canson black drawing papers; in these cases, the immersion

Table 3: Average of changes detected by visual observation (expressed in a scale ranging from 0 = no change to 5 = very severe).

Treatment method applied	Average of changes			
	all papers		velour paper	
	non-aged drawings	aged drawings	non-aged drawings	aged drawings
IMC	0.4*	0.2*	0.4*	0.2*
ultrasonic	0.5*	0.2*	0.5*	0.2*
immersion	1.9*	0.4*	2.1*	0.7*
suction	1.2*	1.0*	0.6*	0.6*

* values are the average of six parameters; for immersion and suction methods, each parameter was calculated from 12 test drawings when all papers are considered, in all other cases, each parameter was calculated from 4 test drawings.

method caused less visible changes when compared to the suction table method, both in non-aged and aged drawings.

3.2 Pigment movement

Lateral pigment movement, caused by contact with free water, was clearly visible with the naked eye in samples treated with immersion and suction table methods (Figs 3 and 4). It was more visible after immersion treatment in non-aged samples (Fig. 3), as might be predicted considering the contact of the pigment particles with free water. Aging, however, significantly altered this situation in the case of the immersion treatment (Fig. 4) but was not significant in the case of suction table treatment. Apparently, increased pigment caking and decreased binder solubility caused by aging (Daniels 1995, 1998) are sufficient to reduce pigment migration caused by contact with free water, yet it does not diminish the effects of the pressure caused by suction.

Pigment movement was not detected visually in the case of the IMC and the ultrasonic mist methods, but under the microscope, these treatments had clearly caused pigment migration, manifested as pigment agglomeration, compacting and penetration into the paper substrate (Fig. 6).

According to these observations, all four methods generally caused comparable degrees of pigment movement and, in the majority of cases, those effects can be described as between mild and moderate (values between 2 and 3 in Table 4). Never-

Table 4: Average of changes, related to pigment movement, observed under the microscope (expressed in a scale ranging from 0 = no change to 5 = very severe).

Method	Average of changes			
	stereomicroscope		SEM	
	non-aged drawings	aged drawings	non-aged drawings	aged drawings
IMC	2.1*	2.0*	2.0*	1.4*
ultrasonic	3.2*	2.7*	3.1*	2.3*
immersion	2.6*	2.3*	3.4*	1.9*
suction	3.4*	2.9*	2.8*	2.2*

*values are the average of three parameters, except in the case of drawings treated by IMC and ultrasonic methods for which only two parameters were determined with the stereo-microscope; each parameter was calculated from 4 test drawings except in case of pigment compacting that was determined with the stereomicroscope for drawings treated by immersion and suction methods and for which 8 test drawings were used.

theless, the IMC method consistently caused the lowest changes, independent of artificial ageing or the analytical method used (Table 4). In contrast to results obtained by visual observation, observations under the microscope suggested that the immersion method caused fewer detectable changes when compared to the ultrasonic mist method, especially in the case of the aged samples. However, these results are only

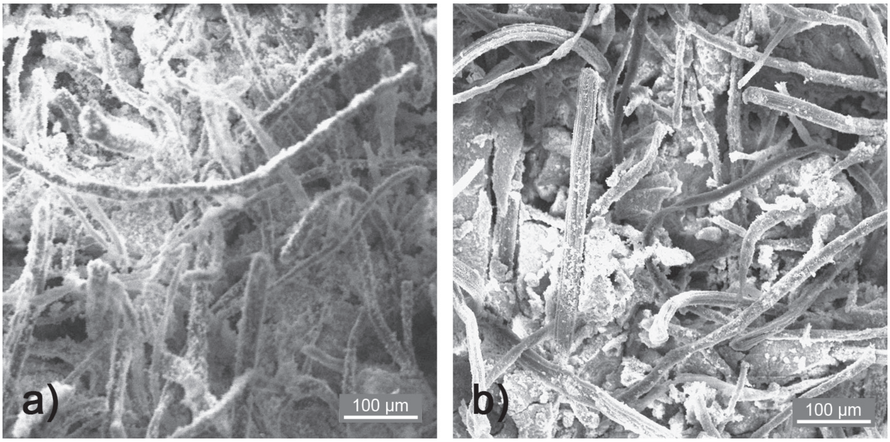

Fig. 6: Velour paper with black pigment (non-aged);
a: reference sample, b: sample of the test drawing treated with ultrasonic mist, showing pigment compacting, agglomeration and penetration into support (SEM images).

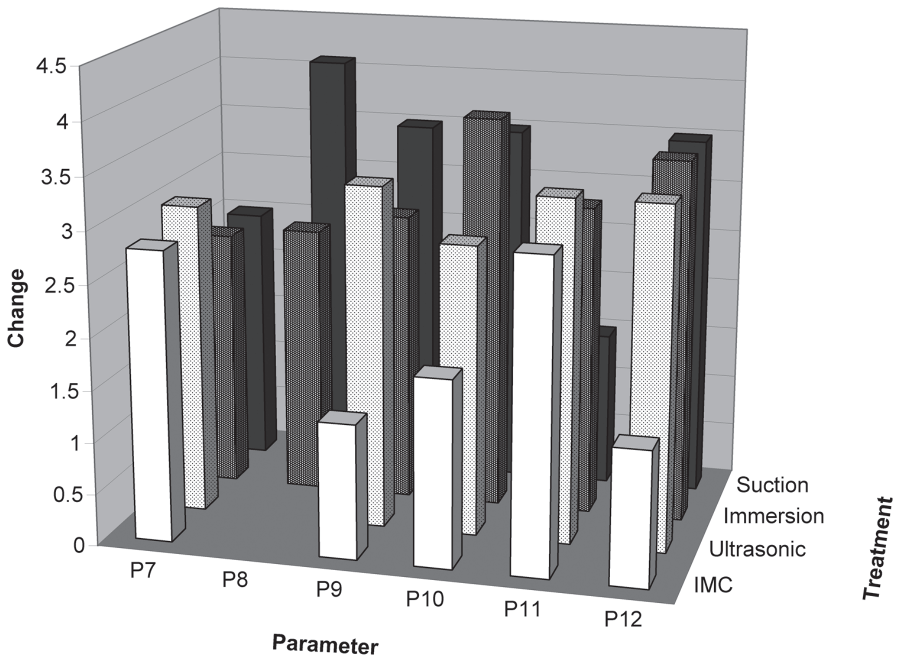

Fig. 7: Changes detected in non-aged drawings under the microscope;
parameters: P7 and P10 = pigment agglomeration, P8 and P11 = pigment compacting, P9 and P12 = pigment penetration: parameters P7 to P9 were determined with a stereomicroscope, parameters P10 to P12 by means of SEM; each parameter was determined from 4 test drawings, except parameter P8 for immersion and suction methods, where 8 test drawings were used for each.

statistical, as can be seen in Figs 7 and 8. Macroscopic and microscopic observations yielded different assessments of the effect of immersion treatment and ultrasonic mist treatment, which can probably be explained by differences in size and texture of the agglomerates formed by the two treatments. No direct relationship between the extent of changes detected by visual observations and the agglomerate features detected under the microscope could be determined.

Considering each of the parameters evaluated under the microscope separately, the changes caused by the IMC method in the aged drawings are described, at most, as mild (values less than or equal to 2), while some changes caused by the other methods, namely the immersion and the suction table methods, exceed moderate (values greater than 3) (Fig. 8). Moreover, the IMC method causes the least changes according to the majority of parameters (Figs 7 and 8), both in non-aged and aged samples. Considering that Daniels (1998) noted that mist treated samples did not display ag-

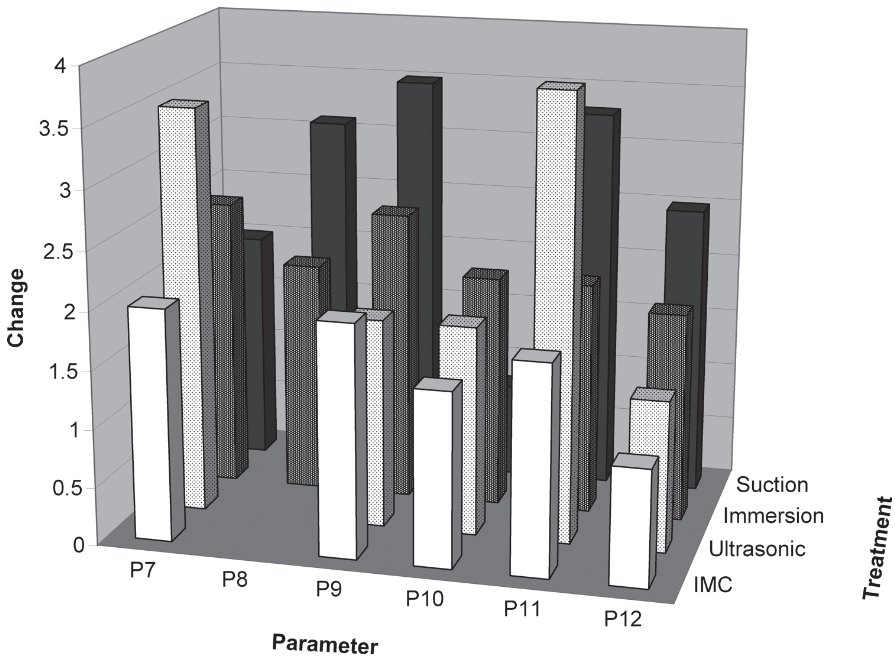

Fig. 8: Changes detected in aged drawings under the microscope; parameters: see Fig. 7.

gregates while still wet and that the major difference between the ultrasonic mist and the IMC methods lies in the drying process, the good results obtained by the IMC method could be related to its drying process. In the IMC process, the samples are placed between two surfaces that exert pressure during the drying process. That pressure may be sufficient to counter the movement of particles, leading to agglomeration, which occur during air drying, driven by interfacial energetic factors (Daniels 1998). The downward forces exhorted by the IMC drying process, during which drawings are placed face down, may have diminished pigment penetration in comparison to drawings which were left to air dry.

3.3 Paper staining and pigment loss

Paper staining and pigment loss were not observed visually in the test drawings treated with IMC and ultrasonic mist methods; partly this was expected in cases where no lateral movement was detected macroscopically (Figs 3 and 4). Pigment loss was neither observed in aged nor non-aged samples treated with the suction table method, which can be explained by the inward forces exerted by suction. Pigment loss was only detected in immersion treated samples which were directly in contact with free water; the loss was much more significant in the non-aged samples. Paper staining was found in suction treated samples almost independently of whether they had been artificially aged or not. Paper staining caused by immersion treatment depends significantly on the aging status of the samples, being described as moderate in the case of the non-aged samples but not detected in the case of the aged samples (Figs 3 and 4).

3.4 Colour changes

All four treatment methods caused visually perceivable colour changes (Figs 3 and 4). Darkening is the most pronounced effect, especially in non-aged drawings, and is little influenced by the treatment method. In the non-aged samples the effect was less than mild while in the aged drawings it was less than very mild. In both cases the best method, according to this parameter, is the immersion treatment. Loss of colour intensity was caused by all treatments, but it was very mild (less or equal to 1) regardless if samples were aged or not aged. The IMC method is the treatment that led to the least amount of changes. This may be explained by the reduced pigment penetration during the IMC drying process.

Regarding hue changes, which was the least visible colour change, the IMC and the ultrasonic mist methods did not cause any detectable alterations in any sample (Figs 3 and 4). As these two methods did not cause pigment movement (macroscopically detectable), paper staining or pigment loss, it is possible that hue changes could be related to changes in the surface topography, as already suggested by Daniels (Daniels 1998).

4. Conclusion

The IMC method (and also the ultrasonic mist method) proved inadequate for treatment of pastel drawings executed on supports with low water absorbency, such as Arches Aquarelle and Canson papers. However, for drawings on velour papers which have high water absorbency due to their open surface structure, the IMC and the ultrasonic mist treatments caused the least changes according to visual observation. It should be noted that both methods imply the use of ultrasonic mist. On a microscopic scale, the extent of change resulting from the IMC method seems to be less than the one caused by the ultrasonic mist method with the drying process being the main difference between these methods. The IMC drying process seems to reduce some adverse effects. Consequently, the IMC method can be recommended as a washing treatment for pastel drawings executed on velour paper – the prevalent support of pastel drawings treated over the years at IMC. The results presented in this study confirm that no aqueous washing treatment leaves the pastel layer unaltered, which has to be considered when discussing treatment options for pastels.

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Note

[1] Velour paper is a term given to papers with a velvet-like finish; they are produced by first coating the paper's surface with an adhesive and subsequently flocking the adhesive coating with fine fibrous particles of rayon, cotton, or wool; velour papers are capable to hold a lot of pigment.

Materials and suppliers

120 T Screen, fabric: polyester printing screen,
mesh count diameter (mesh/cm µm) – 120-34PW(T)
Anyida Hardware Mesh Co.,Ltd, No.106, Hongqi Street, Anping, Hebei, P. R.China 053600, http://www.wiremesh-cloth.com

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Zusammenfassung

Nassbehandlungstechniken für Pastellzeichnungen – eine vergleichende Untersuchung

Am Instituto dos Museus e da Conservação (IMC) wird routinemäßig eine Methode zur Nassbehandlung von Pastellzeichnungen angewandt, bei der das entsprechende Objekt einem „Blotter-Washing“ mit einer alkalischen Lösung in einer Feuchtkammer ausgesetzt wird. Die Möglichkeiten und Grenzen dieser Methode werden mit drei weiteren Techniken verglichen, die in der Literatur beschrieben sind. Dabei handelt es sich um Badbehandlungen in kaltem Wasser, das Durchziehen von wässrigen Aerosolen auf dem Unterdrucktisch und das Aufbringen von wässrigen Aerosolen über einen trockenen Löschkarton. Die genannten vier Techniken wurden auf nichtgealterten und künstlich gealterten Proben, die jeweils mit vier ausgewählten Pastellstiften auf Papier hergestellt wurden, durchgeführt. Die Testreihen umfassten insgesamt 120 Proben. Die Auswirkungen der jeweiligen Behandlung wurden zunächst visuell beurteilt, vor allem in Bezug auf die laterale Verschiebung von Pigmentteilchen, Pigmentverluste, Farbveränderungen, insbesondere Verdunklung der Farbschicht, aber auch Verluste in der Farbintensität. Mithilfe lichtmikroskopischer und REM-Untersuchungen wurden Auswirkungen in Bezug auf die Pigmentagglomeration und -verdichtung sowie das Einsinken von Pigmentteilchen in die Papiermatrix bestimmt. Die Resultate haben gezeigt, dass die am Institut übliche Behandlungstechnik ungeeignet ist für die Anwendung bei Pastellzeichnungen auf Papier mit einer geringen Porosität. Allerdings ist dieses Verfahren im Vergleich zu den anderen untersuchten das geeignetste für die Behandlung von Pastellzeichnungen auf so genannten Velourpapieren – der vorherrschende Typ von Pastellzeichnungen, die in den vergangenen Jahren am Instituto dos Museus e da Conservação (IMC) behandelt wurden.

Résumé

Etude comparative de traitements de lavage pour les dessins au pastel

A l'Institut Portugais des Musées et de la Conservation (IMC) on utilise d'habitude une méthode de lavage des dessins au pastel au cours de laquelle l'objet en question est exposé à un « Blotter-Washing » avec une solution alcaline dans une chambre humide. Les possibilités et limites de cette méthode seront comparées à trois autres méthodes décrites dans la littérature, telles que l'immersion dans l'eau froide, la succion d'aérosols aqueux sur une table à basse pression et la vaporisation d'aérosols aqueux sur un papier buvard sec. Les quatre techniques nommées ci-dessus ont été appliquées à des échantillons vieillis et non vieillis artificiellement qui avaient été réalisés sur le papier par quatre crayons sélectionnés de pastel. L'ensemble des séries de tests a été effectué sur 120 échantillons. Les effets des traitements respectifs ont d'abord été évalués par une observation à l'oeil nu de six paramètres (comme le déplacement latéral du pigment, les taches sur le papier, la disparition du pigment, la perte d'intensité de la couleur, l'obscurcissement et les altérations de la couleur). Ensuite à l'aide d'analyses au microscope optique et à la microscopie électronique à balayage on a pu déterminer les répercussions en ce qui concerne l'agglomération des pigments et leur compression ainsi que leur pénétration dans le support en papier. Les résultats ont démontré que la méthode utilisée habituellement à l'Institut IMC n'était pas appropriée dans le cas de dessins au pastel sur papier présentant une porosité minime. Par contre cette méthode est par rapport aux autres la plus efficace pour le traitement de dessins au pastel sur ce qu'on appelle des papiers velours – c'est surtout ce type de dessins au pastel qui a été traité pendant des années à l'Institut des Musées et de la Conservation (IMC).

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Vera Lory completed her BA studies in general conservation-restoration and her MA in paper conservation, both at the Universidade Nova de Lisboa in 2010. The present study was her dissertation project, which was undertaken during her final-year internship at the paper conservation studio of IMC.

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