Vulpex spirit soap as a cleaning agent for painted surfaces

by Suzanne Ross and Alan Phenix

Introduction

Possibly one of the greatest areas of technological progress in paintings conservation during the last 20 years is in the area of cleaning; that is, the removal of unwanted coatings or deposits, whether these are varnishes, overpaints or deposits of dirt/grime, etc. This period has seen, for example, the emergence of viable approaches to non-contact cleaning, such as lasers of different types (uv, vis, ir) and atomic oxygen plasma. But some of the most significant advances, both in terms of materials and of general approach, have come in liquid, chemical methods of cleaning, largely initiated by the pioneering work of Richard Wolbers.

The result has been that the modern paintings conservator has a diverse range of possibilities for formulating cleaning preparations to deal with different kinds of coating or deposit. These might include any of the following: water, organic solvents, surfactants, thickeners, acidity/alkalinity regulators, enzymes, chelating agents, inorganic salts, plus others. New materials inevitably bring new concerns, and much recent research in the cleaning of works of art has been directed towards evaluating the possible effects of these new cleaning agents and formulations on paint materials. Such studies should be seen as contributing to our collective understanding of the risks (and potential benefits) of their use in practice, so that the conservator can make informed decisions about treatment options and is better able to solve difficult cleaning problems.

Undoubtedly approaches to cleaning have become considerably more sophisticated over the last twenty years, but the broad range of possibilities and materials now available can be bewildering to many practitioners who, quite understandably, appreciate the value of familiar, effective, and readily available commercial products for cleaning.

One such product is Vulpex☐ Liquid Soap which was first introduced in around 1970. One of the perceived advantages of this product was that it offered the possibility of a detergent-type cleaning effect in an essentially non-aqueous environment. Despite all the technological advances alluded to above, a good number of conservators in Europe and North America still use Vulpex to deal with a range of cleaning problems, from surface cleaning through to removal of tough varnishes and overpaint. Although still seemingly quite widely used, Vulpex has perhaps missed out on some of the critical evaluation that is appropriate for materials to be used on valuable items of cultural heritage.

Accordingly, in 2003 we undertook a small research project to examine this product in more detail, particularly its possible effects on paints. (Note 1).

What is Vulpex?

Vulpex is a liquid soap that is described by the manufacturer as *"a safe cleaner for practically everything from paper to stone."* It is supplied as a dense concentrate which must be diluted before use either with water or with a hydrocarbon solvent, such as white spirit. It is, therefore, often described as a "spirit soap" or, more specifically, as potassium methylcyclohexyl oleate. Picreator Enterprises Ltd. of London are the sole manufacturers of Vulpex, which is their registered trade mark. (Note 2).

In concentrated form as supplied, Vulpex is a viscous amber liquid, quite translucent, with a "camphoraceous odour." It is described as being "*non-acid …(it) does not damage even vulnerable or delicate surfaces, assuming the soap is used in diluted form, either with water or white spirit*." According to the material safety data sheet, concentrated Vulpex, as supplied, has a pH of 13±1, so it is quite strongly alkaline.

How, and on what, is it used?

Applications

On the basis of reports in the conservation literature, from the manufacturer and its distributors and from personal communication, it is clear that Vulpex has found use in the cleaning of a wide variety of objects/surfaces including: feathers, costumes, carpet, paper, leather, saddle cloth, bronze statuary, armour, shell, marble, furniture, gilding, and, of course, paintings; though it is perhaps in stone cleaning that Vulpex is used most extensively. (Anon. 1988). Picreator comments that Vulpex has often been used with historic buildings, by UK national conservation bodies such as English Heritage.

It is reported as being particularly effective for cleaning fire damaged items or ones with coatings of soot. (Spafford-Ricci and Graham 2000). It was, for example, apparently, used in the House of Lords, London for cleaning the Peers' staircase murals due to centuries of pollution and obscuring tobacco smoke soot.

Although it is reported rather infrequently in the conservation literature in connection with cleaning paintings or painted surfaces (Jaeschke & Jaeschke 1990), it is clearly a product with which many paintings conservators are familiar, and – at least in the UK - it is common to find a bottle of Vulpex in the chemicals cupboard of many studios. Picreator comments, "*The picture restorers (oil paintings) are the largest class of fine-art users amongst our clientele*." Not only is it used as a detergent preparation for removing surface dirt, but paintings conservators also use it to remove other, tougher coatings that may not be removable, for example, with organic solvents alone. As Burnstock and Learner note, for this purpose there are "*various alkaline soaps, for example Vulpex, a modified potassium oleate. In water they act as anionic surfactants and are used primarily to aid with surface cleaning but they are also very effective varnish (and paint) removers*." (Burnstock and Learner 1992).

This observation that Vulpex is capable of a cleaning action that goes beyond simple detergency (for removing surface dirt) is consistent with anecdotal evidence of the applications for which the product is actually used by practising conservators, which are often varnish or overpaint removal. The enhanced activity of the product is not at all surprising from knowledge of its chemical composition. There is little doubt that Vulpex is a highly effective solublizing agent for hydrophobic substances: as the manufacturers note, "*Vulpex attacks and emulsifies dirt, fats, fatty oils, mineral oils, waxes, and hydrocarbons with great speed and efficiency*."

Recommended dilution and clearance

As noted previously, Vulpex is meant to be used in diluted form, mixed either with water or mineral spirits. In general, Picreator recommends the following concentrations, which are largely echoed by distributors:

- for aqueous cleaning, from 1:6 parts by volume (~14%) or 1:7 (12.5%) to 1:10 (9%) dilution with water, and
- for non-aqueous cleaning, 1:10 (~9%) to 1:20 (~ 5%) in solvent (mineral spirits).

These concentrations, it should be stressed, are the manufacturer's guidelines only. As far as clearance (removal of any residues) is concerned, manufacturer and suppliers effectively advise using the same solvent as is used as diluent: that is application of white spirit for clearance of non-aqueous solutions and water for clearance of aqueous solutions of Vulpex.

Some uncertainties about Vulpex

If one considers, in the abstract, the questions that one would want to address in the evaluation of any cleaning agent or preparation for painted works of art, one may raise the following issues:

- does the user have sufficient knowledge of the composition and activity of the ingredients?
- (for non-volatile substances) would there be a risk of active material being left behind on the surface being cleaned? (i.e. how effective are the measures recommended for clearance of non-volatiles?)
- what are the likely effects of the cleaning agent on the original paint material? Specifically, what are the risks of the agent causing:
    - swelling and softening of the paint binder, with consequent risk of pigment loss,
    - leaching of extractable organic paint binder components,
    - permanent chemical alteration of the paint binder or pigment.

In the short time available for our research project we perhaps have only been able to scratch the surface of these issues in relation to Vulpex, but we hope that our findings will provide some initial enlightenment about this quite widely used conservation material. The following account reports a selection of some of the most pertinent observations on the product.

(i) The composition and activity of Vulpex

Vulpex is described as a potassium methylcyclohexyl oleate soap. From the chemical point of view, however, this description does not give an entirely clear or self-evident picture of the actual ingredients. Superficially, from the name alone, one would presume this to be the potassium salt of a fatty acid, but the nature of the acid is slightly obscure. Is it oleic acid or methylcyclohexyl oleic acid? If the latter, not only is the name irregular, but it would imply an oleic acid moiety side-substituted with a methylcyclohexyl group, which would certainly be unusual.

Some clarification does, however, come from the Material Safety Data Sheet supplied by Picreator. In this document the composition of Vulpex is declared as:

Methyl cyclohexanol	~ 30% (CAS no.583-59-5)
Potassium hydroxide	~ 10% (CAS no. 1310-58-3)
Water and other components up to 100%.	

The identification of the presence of independent methylcyclohexanol should lead us to infer that the oleic acid ('oleate' of the name) is <u>not</u> directly associated with the methylcyclohexyl part, in the sense of being part of the same molecule, and that they are in fact independent species, perhaps in the form of oleic acid (as potassium salt) and methylcyclohexanol, which would behave as effectively as a solvent. If present, methylcyclohexanol then would be expected to contribute some solublizing effect on fatty, greasy materials. (Note 3).

However, there is further possible complication to the role of the methylcyclohexanol, as alcohols may react with strong alkalis to give alkoxide ions. This comes about when an alcohol is in the presence of a strong alkali, such as KOH. The alcohol may act as a conjugate acid and donate a proton, through the equilibrium reaction:

$$\text{R-OH} + \text{OH}^- + \text{K}^+ \rightleftharpoons \text{RO}^- + H_2O + \text{K}^+$$

Interestingly, in their literature, Picreator state that "*the product contains no free alcohol, which is completely reacted with the alkali*." Since a substantial amount of potassium hydroxide is present Vulpex, this might imply, then, that an active ingredient may in fact be the methylcyclohexyl alkoxide base $CH_3C_6H_9O^-$. (Note 4). The presence of 10% KOH will, in any event, mean that the product is quite strongly alkaline (hence the reported pH value of around 13) which will serve to neutralise and solublise the oleic acid soap, to enhance detergency and emulsification of fatty substances, and perhaps also to saponify fats.

On the basis of the information available, therefore, we might hypothesise that the active ingredients of Vulpex may include any of:

free methylcyclohexanol
methylcyclohexyl alkoxide base $CH_3C_6H_9O^-$
potassium hydroxide
oleic acid (as potassium salt)
water
possibly other, unknown components.

In order to test this hypothesis, at least in part, organic chemical analysis was performed on samples of Vulpex from stock, and some findings are reported here.

	Oleate / stearate	Oleate / palmitate	Palmitoleate / palmitate	Palmitoleate / stearate
Pure Vulpex	28.23	9.33	1.09	3.29

Table 1. Ratios of fatty acids present in pure Vulpex as determined by GC-MS

Gas Chromatography - Mass Spectrometry (GC-MS) of Vulpex

(GC-MS) analysis confirmed the presence of many free fatty acids in the Vulpex. (See Table 1). Oleic acid (C18:1) was the major component and was present in large abundance, but significant proportions of other fatty acids were also detected: palmitoleic acid (C16:1), palmitic acid (C16:0), linoleic acid (C18:2), and stearic acid (C18:0).

There are a number of important observations from these results. Firstly, no species were found that comprised both oleic acid and methylcyclohexyl residues, so supporting the view that these are present in Vulpex as independent agents. Free methylcyclohexanol was not detectable under the conditions and derivatization method used in these GC-MS analyses. The presence in Vulpex of several different fatty acids that are also likely to be present in paint films has implications for residue and leaching studies carried out on this material. It may not be an easy task to distinguish, either in extracts or in residues, fatty acids that derive from the Vulpex from those that originate from the paint.

The various fatty acids and their proportions may also give some clues to the process of manufacture of Vulpex. Comparison of the fatty acid abundances in Vulpex with those in various natural fats and oils showed the closest match to any raw oil was olive oil (Table 2). However, the relatively high abundance of palmitoleic acid in Vulpex may count against olive oil being used as the primary raw ingredient. It has been noted that "*the commercial grades of oleic acid prepared from tallow fatty acids by solvent separation, generally contain 6-9% of palmitoleic acid*" (Swern 1979-1982) which may point towards Vulpex being manufactured from commercial grade oleic acid, mixed with KOH, water, and methylcyclohexanol.

	Fatty acid distribution (%)	
	Vulpex	Olive oil
Oleic	76	56-82
Palmitic	8	8-18
Palmitoleic	8	-
Linoleic	6	4-19
Stearic	2	2-5

Table 2. Fatty acid constitution of Vulpex and of Olive oil

Fourier Transform Infra-red (FTIR) of Vulpex

FTIR spectroscopy was performed directly on samples of stock Vulpex using a diamond cell attachment to the infra-red spectrometer. The spectrum obtained for Vulpex was compared to published IR spectra for the various isomers of methylcyclohexanol and with the spectrum of a sample of potassium oleate that was prepared in the laboratory. (Note 5). A strong correspondence was found between the spectrum for Vulpex and peaks in the respective spectra of potassium oleate and methylcyclohexanol, with indications of closest similarity with the 3-methylcyclohexanol and, especially, 2-methylcyclohexanol isomers. As with the GC-MS analysis, the results of infrared spectroscopy therefore tended to support the view that Vulpex contained methylcyclohexanol and potassium oleate. From the IR spectra it was not, however, possible to draw any conclusions on the possible dissociation of the methylcyclohexanol to form the alkoxide.

(ii) Evaluation of effects of Vulpex on oil paints

A series of test were performed to evaluate the possible effects of Vulpex on oil paints. Since the product is intended to be used in diluted form, either in water or in mineral spirits, these tests were carried out using a standard range of dilutions that correlated with conservators' usage and manufacturer's recommendations. The various solutions tested are shown in Table 3, which includes the pH values measured for the aqueous solutions and alkalinity values for the non-aqueous ones. The very low concentration option, 1:100, was included in these tests, since this had been em-

Table 3. Concentrations of test solutions of Vulpex with measured values for alkalinity

Dilution in water (Vulpex : water, parts by volume)	pH of aqueous solutions	Dilution in mineral spirits (Vulpex : min. spirits, parts by volume)	Approx conc. of KOH (Note 6) moles / litre	Approx conc. of KOH (Note 6) g / litre
1:7	12.7	1:7	165×10^{-3}	9.2
1:10	12.3	1:10	92×10^{-3}	5.1
-	-	1:20	44×10^{-3}	2.5
1:100	11.3	1:100	11×10^{-3}	0.61

ployed in one of the few previous evaluations of the cleaning effect of Vulpex, that of Burnstock and White (1990).

Experiments to evaluate swelling, leaching, and the potential for residues were conducted on various reference oil paint films made from Winsor & Newton Artists' Oil Colour. The group of test paints included: thermally aged burnt umber (BU), thermally aged raw sienna (RS), thermally aged lead white (PbW), and light-aged flake white mixed with yellow ochre (#17). These films, especially the light-aged flake white + yellow ochre (#17), have been used previously in studies of the solvent-induced swelling of paints. (Phenix 2002b, Phenix 2003).

Swelling of oil paints in Vulpex solutions

The swelling effect of Vulpex solutions on sample oil paint films was measured by the photomicrographic technique we have used and reported previously. (Phenix 2002a, Phenix 2003). A group of fragments from the test films were immersed in the various concentrations of aqueous and non-aqueous solutions of Vulpex noted in Table 3 and observed under a low power stereomicroscope. Digital images of the fragments were captured through the microscope at intervals, from the moment of initial immersion in the liquid up to 120 minutes or longer. The magnitude of swelling of the fragments was determined from changes in their area over time, which was measured by quantitative image analysis.

The mean proportional change in area plotted against time for the group of fragments in an experiment represents a swelling curve that reflects the particular response of the paint to the immersion liquid, as shown in Figures 1 and 2. Figure 1 shows a selection of swelling curves generated for the test paints in aqueous Vulpex solutions, and Figure 2 shows selected swelling curves for Vulpex solutions in mineral spirits (Stoddard Solvent). Some swelling curves obtained in previous studies for the test paints immersed in selected organic solvents are also included for comparison.

A great deal could be said about the swelling effects observed in these experiments, but it is sufficient here just to mention some key points:

- All paint types tested swelled significantly in the various Vulpex solutions. The burnt umber film showed the strongest swelling response of the films tested.
- Prolonged exposure to the Vulpex solutions led to disintegration and solubilisation of the paints.
- Aqueous solutions of Vulpex generally produced a markedly greater magnitude and rate of swelling than comparable mineral spirit solutions.
- Prolonged exposure to the 1:10 aqueous solutions of Vulpex ultimately caused massive (>100%) swelling of the burnt umber paint (the highest values we have recorded for any liquid – compare with the strong-swelling solvent N-methylpyrrolidone, which is also shown).
- Immersion of paint in a more dilute aqueous solution showed a much-reduced rate and general effect of swelling.
- Significantly, if allowed to continue for long periods, the swelling of the paints in all Vulpex solutions did not level off at an equilibrium or maximum value (as usually occurs with solvents), but continued indefinitely, leading to eventual disintegration of the samples.

These experiments indicate that the more concentrated <u>aqueous</u> solutions of Vulpex (approaching 1:10) are capable of inducing quite rapid and substantial swelling of oil films and, therefore, might be expected to involve a high element of risk when used for cleaning oil paintings. Aqueous Vulpex at a dilution of 1:10 was an extremely active agent on these paints. The risk of swelling can be greatly reduced through the use of lower concentration aqueous solutions (for example, 1:100) and, especially, through the use of Vulpex in mineral spirits. At least in the early period of immersion, such solutions generally produce only low-moderate or moderate swelling of the paints. For example, up to 20 minutes immersion, all of the solutions 1:100 aqueous, 1:10 mineral spirits, and 1:100 mineral spirits produce appreciably lower levels of swelling on burnt umber than, say, the solvent xylene, but greater than the effect of pure mineral spirits.

The disintegration of the paint samples that was observed on very prolonged immersion is almost certainly a consequence of the strongly alkaline nature of Vulpex. While it would be improbable that, in the actual cleaning of a painted surface, oil paints would be exposed for such long periods, this observation does emphasise the importance of effective clearance of the cleaning agent in order to avoid long-term chemical alteration of the paint.

Scanning electron microscopy of paint samples treated with Vulpex

The results of SEM examination of selected paint samples immersed in aqueous and non-aqueous solutions of Vulpex tended to confirm the general picture obtained from the swelling tests regarding the comparative activity of the various solutions. Again, the substantially greater activity of the aqueous solutions was indicated.

Leaching

In addition to helping characterise the nature of the Vulpex as has been described above, organic chemical analysis by gas chromatography-mass spectrometry was used to examine the potential for Vulpex solutions to extract organic components from the oil paint binder. GC-MS analysis of raw Vulpex had indicated the presence of a large abundance of oleic acid, plus quantities of palmitic, palmitoleic, linoleic, and stearic acid, which – with the exception of palmitoleic acid – may all be present in (young) oil films. In order, then, to assess any potential for leaching it was necessary to measure changes in <u>ratios</u> of the fatty acids present, as those present in pure Vulpex were similar to those present in

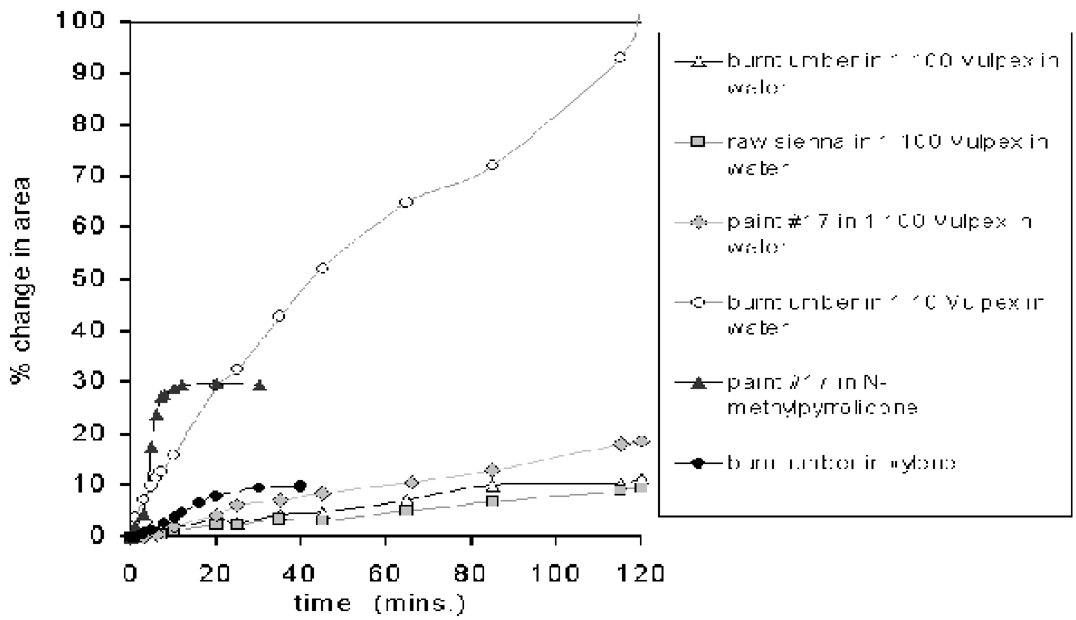

Figure 1. Swelling curves of various paint films in aqueous solutions of Vulpex compared to swelling in two solvents

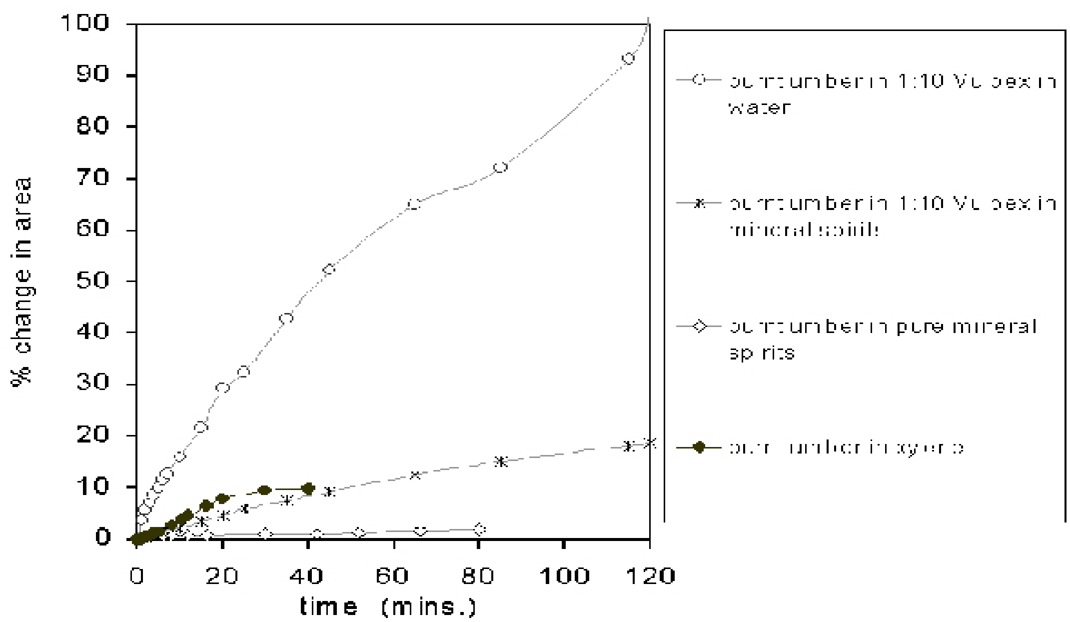

Figure 2. Swelling of burnt umber paint films in Vulpex solutions and comparison with two hydrocarbon solvents

	Oleate/ Stearate	Oleate/ Palmitate	Palmitoleate/ Palmitate	Palmitoleate/ Stearate
Vulpex	28.23	9.33	1.09	3.29
Burnt umber (#BU)	0.08	0.06	–	–
Raw sienna (#RS)	0.01	0.10	–	–

Table 4. Ratios of fatty acids present in pure Vulpex and the various test paint samples

oil paint. Some key fatty acid ratios for Vulpex and the test paint films are shown in Table 4. The presence in Vulpex of palmitoleic acid was useful. Since there was effectively no palmitoleic in the paint, the ratios of other fatty acids to palmitoleic in the liquid should stay relatively constant unless components are extracted or deposited. Indeed, unlike conventional leaching tests with organic solvents, with Vulpex there is the additional potential for fatty acids to be deposited from the cleaning liquid, as well as extracted from the paint, and this possibility is an additional factor that must be taken into consideration

In order to assess whether fatty acids could be extracted from the paint films by Vulpex solutions, or indeed deposited from them, small samples of the test paints were immersed in various solutions and the extracts run through GC-MS to detect changes in ratios. After the specified period of immersion, the supernatant liquid was acidified, extracted, derivatised, and run through GC-MS as described previously. Any change in fatty acid ratios, compared to pure Vulpex, would suggest exchange of fatty acid components between the paint and the surrounding solution. Some selected results for aqueous 1:10 and 1:100 Vulpex solutions are shown in Table 5.

Admittedly, these are quite long periods of exposure to the Vulpex solutions, especially the 21 hour immersion; much longer than would occur in the actual situation of cleaning a painted surface. However, comparison of the oleate/ stearate and palmitoleate/ stearate ratios of the immersion liquids after treatment indicates that there is potential for exchange of fatty acids between paint and solution. Most notable changes were found in the case of the burnt umber paint film in 1:10 aqueous Vulpex for 1 hour and raw sienna in aqueous Vulpex for 21 hours, the results for both of which suggest an increase in the presence of stearic acid in the liquid (i.e. extraction from the paint) or else depletion of oleic acid (deposition from the solution).

Residues

At least some of the components of Vulpex are non-volatile: oleic acid and potassium hydroxide being the most significant. In the practical usage of Vulpex as a cleaning agent for paint, it is important that these components are fully removed from the surface. Some initial tests were conducted to try to evaluate the effectiveness of the recommended clearance processes. This was done using GC-MS to try to identify any accumulation of oleic acid during exposure to Vulpex solutions and subsequent clearance and using XRF to try to indicate any deposition of potassium. Evidence for slight increases in the abundance of oleic acid was found for the burnt umber exposed 1 hour to 1:10 and 1:20 solutions of Vulpex in mineral spirits and to a 1:10 solution in water.

Table 5. Ratios of fatty acids in supernatant liquid after immersion of paint samples

Liquid	ratio Oleate / Stearate	ratio Palmitoleate /Stearate
Pure Vulpex	28.23	3.29
Burnt umber 1:10 Vulpex in water, 1 hour immersion	11	1.05
Raw sienna 1:10 Vulpex in water, 1 hour immersion	19.85	2.19
Lead white 1:10 Vulpex in water, 1 hour immersion	20.83	2.37
Burnt umber 1:100 Vulpex in water, 21 hours immersion	23.33	2.76
Raw sienna 1:100 Vulpex in water, 21 hours immersion	17.82	1.82
Lead white 1:100 Vulpex in water, 21 hours immersion	21.31	2.2

	Potassium ions detected, as percent
pure Vulpex	>5.87%
untreated burnt umber paint film	0.54%
after immersion in 1:100 Vulpex in H_2O	0.97%
after immersion in 1:10 Vulpex in H_2O	3.39%
after immersion in 1:20 Vulpex in mineral spirits	4.45%
after immersion in 1:10 Vulpex in mineral spirits	6.19%

Table 6. Results of XRF showing proportional abundance of potassium ions in burnt umber sample paint films before and after immersion in aqueous and non-aqueous formulations

The results for potassium were more telling. XRF was used to analyse the proportion potassium ions on the surface of burnt umber paint samples after immersion for 1 hour in various Vulpex solutions, with subsequent clearance. As recommended, for aqueous solutions water was used to clear the surface by swabbing, and for non-aqueous mineral spirit was used. The proportional abundance of potassium ions detected are shown in Table 6. The proportion of potassium in pure, neat Vulpex was determined by XRF to be >5.87% by mass.

These results indicate that, in all cases – even with clearance – the potassium content of the paint was increased as a consequence of exposure to the cleaning solutions. Whether this would be accompanied also by accumulation of OH- ions remains uncertain at this point. As might be expected, the lower concentration solutions leave smaller amounts of potassium behind. Interestingly, however, it is the solutions in mineral spirits that leave the greatest residues of potassium, perhaps because of the lower solubility of ionic species in a hydrocarbon solvent such as was used for clearance.

The question remains, also, whether these quantities of residual material would have any potential long-term effect on the paint. Any residual alkali, especially, might be expected to have some influence on the pattern of ageing/deterioration of the paint and, possibly on the future sensitivity of paints to cleaning agents such as organic solvents. Some preliminary tests we conducted were inconclusive, but there were sufficient indications to suggest that this would be a useful line for further investigation.

Summary and Conclusion

It is hoped that the above observations have helped to clarify some issues to do with the use of Vulpex for cleaning painted surfaces. In the first instance, there is some greater certainty about the likely ingredients of the product and their functions. It has been demonstrated also that Vulpex can be quite an active agent on oil paint films, especially if used in water at concentrations approaching 1:10 or greater. Such solutions might potentially have quite a strong swelling and solubilizing effect on oil paint, especially if used for a somewhat prolonged application, and the conservator is advised to use them with some degree of caution.

The activity of aqueous Vulpex solutions (and the consequent risks for oil paint) can be substantially reduced by lowering the concentration as far as is practicably possibly. A solution at 1:100 dilution was considerably less active on oil paint than one at 1:10 dilution. However, it might be expected that the cleaning activity of the more dilute solutions is similarly reduced, and the practical conservator will be trying to find an optimum balance between activity-on-coating and activity-on-paint. Adjusting concentration between these levels may be one way of achieving this balance.

Certainly, the solutions of Vulpex in mineral spirits were considerably less active on oil paints than the corresponding aqueous solutions, in terms of induced swelling. The mineral spirits option, also involving control of concentration/dilution, may provide a more effective way of reducing the activity of the cleaning agent on oil paints. However, clearance of residual Vulpex with mineral spirits does not appear to be as directly effective as it is with water, especially regarding potassium. When using the potassium methylcyclohexyl oleate soap in mineral spirits, therefore, we would recommend that the practitioner rinses the surface as thoroughly as possible to be confident of effective clearance. Given that clearance appears more effective with water, one might raise the question of whether a double clearance process might be most effective when using Vulpex in mineral spirits - first rinse with pure mineral spirits, allow to dry fully, followed by rinse with water (provided the surface can tolerate water) - an approach which has been suggested for other types of surfactant cleaning preparation.

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Notes:

1. This article is based on the findings of a research project carried out in 2003 by Suzanne Ross, "An investigation into Vulpex, a potassium methylcyclohexyl oleate soap" as part of her studies towards an MA Conservation of Fine Art (Easel Paintings) at Northumbria University, Newcastle upon Tyne, UK. The authors would like to thank Picreator Enterprises for their co-operation with this work.

2. Picreator Enterprises Ltd., 44 Park View Gardens, Hendon, London NW4 2PN, UK. Tel: + 44 (0)208 202 8792, fax + 44 (0) 208 202 3435. www.picreator.co.uk.

3. Methylcyclohexanol is a solvent of intermediate polarity, which might also be expected to have weak surfactant properties on grounds that it has some amphiphilic character, i.e. it contains a hydrophobic, lipophilic element (the hydrocarbon skeleton) and a hydrophilic element (the –OH group). Teas fractional solubility parameters for methylcyclohexanol are not published, but one would expect them to be similar to those of cyclohexanol which are: fd 50, fp 12, fh 38.

4. A similar situation probably occurs in a chemical reagent occasionally used by conservators for removing stubborn (oil) overpaint, namely "alcoholic caustic." This reagent comprises a solution of sodium or potassium hydroxide mixed with ethanol in which at least some of the ethanol will be present as ethoxide ion, $CH_3CH_2O^-$.

5. To create solid potassium oleate, oleic acid and potassium hydroxide (40% potassium hydroxide [Analar] solution) were mixed and the water left was evaporated off.

6. In a non-aqueous system such as this, realistically, pH cannot be measured, so an alternative approach to determining alkalinity was used. The 10 ml aliquots of the various solutions of Vulpex in mineral spirits were titrated with 0.01M HCl, with the end-point of the neutralization being visualized with Methyl Orange indicator. The amounts of KOH in the solutions are here expressed in moles/litre and g/litre of the made-up, diluted Vulpex solutions.

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As Beatrice followed the instruction, she asked. "How in the world did someone discover that this was safe to eat?"

"There is a method to tell compatibility when you encounter something different. It begins with your sense of smell. It is very important that you learn to smell everything, not just plants. Smell the air, the water, animals, even other people. Smells are distinct, and you must not forget how something smells. When you have enough comparisons, you will note that poisonous substances often have very strong, individualized smells. If a plant does not smell of a poison you recognize, then next you should break off a portion and rub it upon your body. Use a tender area such as your eyelid, around the nostrils, or under your arm. Wait to see if any sting or discomfort develops, of if itching, or any raised marks, or blisters appear on your skin. If not, then you may try one taste, but put the taste upon the side of your mouth or under you upper lip and again wait for the body's reaction. If there is none, you may increase the taste to slightly larger sample. Gargle some juice at the back of your throat before spitting it out, again waiting to see how it feels before you swallow any. Once you ingest a sample and swallow, you must wait to see if this causes any stomach pain or if your body rejects the food by forcing it back out of your mouth or running out the bottom. Wait long enough to see if it affects your thinking or walking."

from Message from Forever *by Marlo Morgan*
a story of Aboriginal life in Australia