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Art Technological Source Research

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Conservation and Restoration of Cultural Heritage, Technical Art History

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Part II: Reconstructing Two Sticklac-Based Recipes from the 'De Mayerne MS'

Figure 1: Suzanne making sticklac-black pigment (left). Photo credit: Jan van Daal.

Figure 2: Jan coating the paint samples with varnish (right). Photo credit: Jenny Boulboullé.

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1. General introduction

The Sloane MS 2052, better known as the 'De Mayerne Manuscript' is an early seventeenth-century (ca. 1620 – 1644) compilation of recipes, experiments, anecdotes and more pertaining to the visual arts, with a focus on painting techniques. The author of this manuscript is the Swiss physician Théodore Turquet de Mayerne (1573 – 1654/1655). Because of the technical and practical information present in the manuscript it is an indispensable source to the study of sixteenth- and seventeenth-century art production and workshop practice. Reconstructions of historical recipes and works of art are often crucial to understand art production and workshop practice. Consequently, the De Mayerne Manuscript is often used as practical guide in carrying out historical reconstructions.

The importance of the De Mayerne Manuscript as art technological source is the reason that it was chosen for the historical reconstructions carried out by the students from the paintings and technical art history disciplines as part of the Art Technological Source Research course. This course is part of the Conservation and Restoration of Cultural Heritage master's at the University of Amsterdam. The goal of the reconstructions within this course is to increase students' experience in the interpretation and reconstruction of historical recipes, and to equip students with insight on the completeness, understandability and context of their recipe(s).[1]

A preselection of recipes was made by Maartje Stols-Witlox and Jenny Boulboullé, who coordinated the De Mayerne reconstructions. The present authors selected recipe cluster 6 at random. Recipe cluster 6 consists of two recipes, one for a pigment and one for a varnish. While the recipes are unrelated within the manuscript, both the pigment and the varnish are made from the same raw material. This raw material central within the two experiments is a resinous substance secreted by lac insects (image 1.1), called sticklac (image 1.2). The terminology and production processes pertaining to sticklac will be clarified in the introductory paragraphs of the two experiments, the first of which is the production of a pigment and the second the production of a varnish.

[1] As specified in the course's instructional document for the De Mayerne reconstructions.

2. Transcription & Translation

De Mayerne Manuscript (Sloane M.S. 2052) *"a black as beautiful as ivory black"*
Folio 29 recto
'La Lacque qui vient des Indes Orientales est vne excellente couleur representant les plus belles anemones rouges qui se puissent voir. Icelle bruslée en creuset couuert jusques a noirceur seulement faict vn noir aussi beau que celuy d'yuoire & qui a plus de corps. Ceste lacque sestend merueilleusement si qu'vne once dicelle est presque suffisante pour la vie d'vn Enlumineur, faisant des petites pieces comme portraicts ordinaires.'[2]

Translation *"a black as beautiful as ivory black"*
'The lac that comes from East India is an excellent color similar to the most beautiful red anemone that can be seen. Burn it in closed crucible until it darkens, it will be a black as beautiful as ivory black, and it has more body. This lac is wonderfully suitable to such an extent that an ounce is almost enough for an entire lifetime of an Illuminator that makes small works such as normal portraits.'

Notes and discussion of the first recipe *"a black as beautiful as ivory black"*
The first sentence of the recipe we translated by using the french transcript from Berger and the italian translation by Rinaldi.[3] The english translation was not quite accurate, since the author translates 'couleur' and in italian 'colore' as paint, where De Mayerne intends the pigment and therefore we translated it as 'color'. The problem with both recipes already arose in the form of the terminology of 'la lacque' and 'la lacca'. At first we understood this to be lake and assumed that De Mayerne intended the pigment red lake of which he speaks in the second part of this sentence. The second sentence was rather conflicting, since we could not understand why you would burn perfectly good red pigment in order to make black. The translation was made from both the french, english and italian, we found in this sentence the translation to be accurate. Then we gathered that De Mayerne must have been talking of the raw product from the lacquer tree which is often referred to as 'lacquer', but also 'lac' and 'lake'. Since 'lacquer' is a term that is also used in the sense of lacquerware, we deemed this not suitable for the translation of 'lacque'. Lake was conflicting as well, since we use this term for the pigment red lake, that precipitates on a substrate, which left us with the only right translation 'lac'. The term 'lac' refers to the product that comes from the lacquer tree from which you can make lacquer and a red lake pigment. For the last sentence we chose to translate with 'is wonderfully suitable', since 'si stende' can mean several things, such as 'stretching itself' or 'bending itself'.

[2] De Mayerne, Theodor Turquet. Quellen für Maltechnik während der Renaissance und deren Folgezeit (XVI. - XVIII. Jahrhundert) in Italien, Spanien, den Niederlanden, Deutschland, Frankreich und England nebst dem De Mayerne Manuskript (zum ersten Male herausgegeben, mit Übersetzung und Noten versehen). Ed: Berger, Ernst. München: Callwey, 1901.
[3] Rinaldi, Simona. *Pittura, scultura e delle arti minori 1620-1646: ms. Sloane 2052 del British Museum di Londra*. Anzio: De Rubeis, 1995.

De Mayerne Manuscript (Sloane M.S. 2052) "*Indian varnish"*

Folio 21 verso
'Vernix des Indes. Lacque. La Gomme lacque se dissoult tant seulement dans huile d'Aspic, s'estend auec le doigt sur ce qui on veult, & quelque besoigne que ce soit. C'est le vernix de L'albine. Les compartiments, ouurages & peintures se font dessoubs, puis la lacque se couche au dessus. Note: Ceste dissolution se face à loisir à la caue au froid, auec fort long temps. Essayés si d'amollir la Lacque par infusion en spirito vino n'aidera point à la dissolution.'

Translation "*Indian varnish"*
'Indian Varnish. Lac. The gum lac dissolves in spike lavender oil, one can spread it out with their fingers where you want to and on each work. It is the Chinese varnish. The sections, decorations and the painting one makes underneath this, on top of that one puts the lac. This solution is made as needed. Try if the breaking down of lac is facilitated by the infusion of ethanol.'

Notes and discussion of the second recipe "*Indian varnish"*
The first short sentence is rather straightforward, and for the second "sentence" we used the terminology that we applied in the first recipe, which in this case leads to the word 'lac' since it concerns the primary product of the lacquer tree from which you can make varnish. The term 'Gomme' we translated in the same manner as in the first recipe, namely 'gum'. In this case we believe it refers to the shape or consistency of the lac. 'Huile d'aspic' presented more of a challenge, since the english translation is incorrect. We used the Google search engine with both 'huile d'aspic' and 'olio di spigo' from which we gathered that the correct translation was spike lavender oil. The rest of the recipe we translated by using the french transcription and mostly the italian translation.

"a black as beautiful as ivory black"

English translation Fels 2004	**Italian translation Rinaldi**
The lake that comes from East India is an excellent paint like the most beautiful red anemone that can be seen.	La lacca che viene dalle indie orientali è un eccellente colore simile ai più begli anemoni rossi che si possano vedere.
Burned in a closed crucible until it blackens, the same produces a black as good as ivory black and has more body.	Solamente quella bruciata in un crogiolo coperto fino all'annerimento, fa un nero tanto bello come quello d'avorio, ed ha più corpo.
This lake can be wonderfully applied and an ounce of it almost suffices for the lifetime of an illuminator who makes only small pieces like the usual portrait.	Questa lacca si stende meravigliosamente così che un'oncia di essa è pressoché sufficiente per la vita di un Miniatore che fa delle piccole opere come ritratti ordinari.

Indian varnish

English translation Fels 2004	Italian translation Rinaldi
Indian varnish. Lacquer. Lacquer dissolves of itself in spikenard oil, it is spread out with the finger on what and where it is needed.	**Vernice delle indie. Lacca.** La Gomma lacca si dissolve solamente nell'olio di spigo, si stende con le dita su ciò che si vuole e su qualsiasi opera.
This varnish is from China. The arrangements, works, and paintings are put on below, then the lacquer is put over it.	È la vernice della Cina. I riquadri, i decori e le pitture si fanno al di sotto, poi la lacca si stende sopra.
Note: This solution is made as needed in the cellar, in the cold, over a long time. Try if softening the lake by soaking in ethanol does not foster dissolving.	Note Questa dissoluzione si fa a piacere. Provate se la dissoluzione della lacca sarà facilitata ammollandola per infusione nello spirito di vino.

3. Context

To create context for these lac recipes, we have looked at several matters. Firstly, the discussion of the recipes by De Mayerne himself. The first part of the manuscript contains a list of oil colours, where he mentions 'lacque'.[4] In this case he referred to the red lake pigment[5], which was made from lac and was a very common colour to be mixed with oil. He does state that it can be both used for 'glacer, & peindre'.[6] 'Glacer' being the main purpose of lac, however the translation of this word is rather unclear. In this regard we believe it to refer to a manner of glazing, which could be, for example, the application of a varnish. De Mayerne also describes lac to have little body of colour. In addition, lac is not a colour that dries on its own, it needs the 'grünspan', also known as verdigris in order to dry properly.[7]

The Indian varnish recipe is then mentioned in between the discussion of the properties of linseed oil and different painting colours. The '*a black as beautiful as ivory black*' recipe is discussed under the following caption:

"*Tiré des discours tenus auec Mr. Huskins Excellent peintre Enlumineur. Le 14 Mars 1634.*"[8]

The recipe was a product of a dialogue between De Mayerne and the miniature painter John Hoskins.[9] This is highly relevant, since the colour had not been discussed as an oil colour. The pigment was intended for miniature painting, therefore the reconstruction needed to be adapted to this type of artisanal practice. The artist has also been presumed to have written the Gyles manuscript, which elaborates upon the limning and first-hand knowledge of the practice of Nicholas Hilliard.[10]

The Grove Encyclopedia of Materials and Techniques in Art[11] was of vital importance in understanding the techniques and materials used in both recipes. English miniatures were commonly painted on parchment or vellum and the paint medium used was watercolour. A watercolour is described as a pigment dissolved in water bound with a colloid agent. Usually the colloid agent is gum Arabic, other substances such as egg yolk or white, animal size or the casein of the cheese also have been used. The first proper list of miniature colours was given in Edward Norgate's *Miniature or the Art of Limning*, which he wrote for De Mayerne.[12] Norgate wanted to familiarize De Mayerne with the techniques of the art of limning. Since he was both chemist and amateur artist, the first edition of Norgate's treatise was written under the assumption that its reader had basic knowledge of painting. In addition, in this first version Norgate has directed several sections directly to his intended audience, De Mayerne.[13] More importantly, De Mayerne wanted Norgate to provide him with a proper discourse on the colours used by miniaturists:

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[4] Berger 1901: 100.
[5] We know that he referred to the pigment, since the German translation of this was 'Lackrot' and he discusses it under the caption 'colours d'huile'.
[6] Berger 1901: 104.
[7] *Ibidem*: 132.
[8] *Ibidem*: 150.
[9] Both the date of the meeting or interview and the name led us to the miniature painter John Hoskins.
[10] Reynolds, Graham. *English Portrait Miniatures*. Cambridge: Cambridge University Press, 1988. p 38.
[11] Ward, Gerald W.R. *The Grove Encyclopedia of materials and techniques in art.* New York: Oxford University Press, 2008.
[12] Ward 2008: Entry Support 642; Entry Watercolour 747.
[13] Norgate, Edward. *Miniatura or the art of Limning*. New Haven: Yale University Press, 1997. p 12.

"*His desire was to know the names nature and Property of the severall colours of Limning commonly used by those excellent Artists of our Nation (which infinitely transcend those of his), the Order to be observed in preparing, and manner of working those Colours soe prepared..(..)..*"[14]

So not only did Norgate provide De Mayerne with a list of pigments suitable for miniature painting, additionally he described the properties and how to make these pigments. Norgate also mentions that all limning colours are mixed with gum Arabic, with the addition of a little bit of water.[15] Even though he does not mention the black made from lac, Norgate does describe the process of making blacks. Particularly he mentions how for example for cherrystone and ivory black, you need to burn cherrystones or ivory in a crucible, which is rather significant, since we will be reconstructing this process as well.[16]

For the Indian varnish recipe, we turned to the 'resin' entry. The lac that comes from India is produced by an insect *Laccifer Lacca*. The resin has commonly been used as a varnish and was dissolved in alcohol.[17] Varnishes are made from a natural resin, which in this recipe is the lac, and a boiled oil, here the spike lavender oil. However, there is no mention in the recipe of boiling the oil.[18]

[14] Norgate 1997: 58.
[15] *Ibidem*: 62.
[16] *Ibidem*: 64.
[17] Ward 2008: Resin pp 573-574.
[18] *Ibidem*: 729. This is an important choice we made to go with a cold varnish, we were not sure if this is a matter of tacit knowledge that De Mayerne had about making varnishes, or that this is how he had learned of the recipe.

4. Experiment 1

4.1 Introduction experiment 1

Folio 29 recto of the De Mayerne Manuscript is dedicated to the first half of a conversation about pigments between De Mayerne and the English miniature painter John Hoskins (1589/1590 – 1664), which took place on the 14th of March 1634. The text includes a multitude of methods to produce different pigments, but of importance to the current experiment is the section on how to create excellent black pigment by burning Indian lac. The lac, described as "La Laque qui vient des Indes Orientales" was commonly used to create a high-quality red but according to Hoskins this lac could be used to create a black that is as beautiful as ivory black, but with better 'body'.

The lac in question is most likely Indian sticklac. As explained by Velson Horie in *Materials for Conservation* sticklac is a resinous substance secreted by a certain type of south-Asian scale insects (*Tacchanlia lacca*). The insects secrete this substance on twigs, which are harvested as sticklac. This sticklac is washed and heated to remove impurities and functions as raw material for a red dye which can be extracted during washing and for shellac or beadlac, depending on the shape in which the purified material is cooled.[19]

De Mayerne does not mention this black pigment at any other point in the manuscript, neither does any modern publication dedicated to historical pigments. The most striking absence of a mention about sticklac-black is in the *Pigment Compendium*'s sections on Indian lake and lac.[20] Considering the absence of sticklac-black in texts outside this recipe, the prime goal of this experiment is to establish whether Hoskin's proposition that one can make black pigment by burning sticklac is indeed correct. To test the workability of the resulting substance as pigment, it will be tested by using it in combination with the binding medium and support as would have been commonly used by English miniature painters in the seventeenth century. The test will consist of evaluating the subsequent paint based on the two criteria mentioned by Hoskins: it should be as beautiful as ivory black, and it should have better 'body'.

Summarizing the above, the hypothesis for the current experiment is that, based on the instructions in the De Mayerne Manuscript, it should be possible to create a black pigment by burning sticklac, which is optically identical to ivory black and has superior handling properties in the form of a paint.

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[19] Horie 2010: 258.

[20] Eastaugh *et al*. 2008: 198, 220.

4.2 Experimental set-up

The materials for the preparation of both experiments:

- 100 grams of sticklac[21] (figure 3)
- 12 glass jars
- paper towels
- palette or something similar

Materials for experiment 1: ‘a black as beautiful as ivory black’.

- Prepared Lac A, B, C (figure 4)
- Scales
- Crucible with lid[22] (figure 5)
- Burner in the metal studio for setting up[23]
- Leather apron & safety glasses
- Elfenbeinschwarz[24]
- Gum Arabic[25] (figure 6)
- Water
- Linseed oil
- Hotplate
- Pot
- Piece of parchment[26] (figure 7)
- Pliers
- Measuring spoons or cups for both of the pigments
- Measuring pipet

Phase 1: Preparation for both experiments - the processing and measurements of the basic lac

The display of the RCE on the ground floor of the contained differently processed sticklac. The raw material sticklac which had not been washed, the sticklac that had been washed once and the sticklac that had been washed twice. In addition, other ways of processing sticklac were displayed. Since both the recipes did not specify whether the sticklac was processed, we decided to make all three stages of the sticklac to see if there would be a noticeable difference between the three. This translated into the following workplan for the preparatory phase of the experiments:

[21] The sticklac was provided by Art from the RCE.
[22] Ceramic crucibles were provided by the Metal Conservation Studio of the UvA.
[23] In consultation with Jenny Boulboullé and Ellen (Metal Conservation UvA), we were allowed to work in the soldering and welding department of the Metal Conservation Studio of the UvA.
[24] This is a pigment from Kremer, since the real ivory black is nowadays forbidden. This is a synthetic variant which was provided by the Paintings Conservation Studio of the UvA.
[25] The gum Arabic was provided by Jenny Boulboullé.
[26] The parchment was provided by the UvA Paper conservation studio from the box of scraps.

1. Measure 30 grams in three jars.
2. 2 jars completely filled with water, probably with a lid. The third jar is product Lac A.
3. Take an extra jar, which can hold 200 ml, and put one paper towel in the opening of the jar. Pour Lac B with the particles through the cloth. Repeat this for Lac C, but drain the liquid in the same jar as you have done with Lac B.
4. Let the lac particles dry in plastic palette with paper towels (figure 8).
5. Repeat step 3 for Lac C.
6. We washed the lac B in a sieve for two minutes under the tap and we washed lac C for 4 minutes under the tap. Then we dried both Lac B and C separately in paper towels and rubbed it until it is dry and to drive off more dirt.
7. After the Lac A, B, C have dried, divide equal amounts of Lac A over four jars.
8. Repeat this step for Lac B and Lac C.

Phase 2: the experiments

Experiment 1: *'As beautiful as ivory black'*

For this recipe the most important consideration was the actual burning of the crucible. The Metal Conservation Welding and Soldering Studio was available to work in. In consultation with Ellen we decided to burn the crucible until the sticklac was completely burned through and had carbonized, since no specific amount of time was given in the recipe. We decided to repeat the process with Lac A, B, C, but then letting the crucible burn 4 minutes longer after the fire had gone out. This translated into the following workplan:

1. Put the 10 grams of Lac A in the crucible and close it with iron wire. Place the crucible in the 'hunebed'.
2. Switch on the burner.[27]
3. Burn it until there are orange flames and keep on burning until they go out.
4. After the Lac A has darkened, take it out of the crucible and ground it with a pestle and mortar.
5. Put about a table spoon of gum Arabic and a table spoon of water in a jar and heat it au bain marie until the gum Arabic has dissolved (figure 6).
6. Mix a little bit of the burnt Lac A with gum Arabic - water mixture on a glass plate with a palette knife until the paint does not fall off the palette knife, then you have the right consistency. When you start painting, dip your brush in a beaker with water and scrape some paint off the glass plate with the palette knife. With the wet brush blend the paint on the pallet knife (figure 9).
7. Paint stripes and S-shapes on the parchment with a brush.
8. Repeat step 1 to 7 and replace Lac A with Lac B and again with Lac C.
9. Repeat step 1 to 7 for the second batches of Lac A, B, C, but step 3 has the addition that after the flames go out, you continue to burn the crucible for an additional 4 minutes.

[27] First open the gas tap and check if the compressed air is at 3 on the meter, then open the tap on your burner until you hear a small hazing sound. Light it with a lighter. Then open the tap for compressed air on the burner by pushing it away from you. Add more gas for a bigger flame. And add more compressed air to focus the flame.

Figure 3: Unwashed sticklac. Photo credit: Suzanne Bul.

Figure 4: Three stages of processed sticklac. Photo credit: Suzanne Bul.

Figure 5: Crucible with lac A prior to burning. Photo credit: Suzanne Bul.

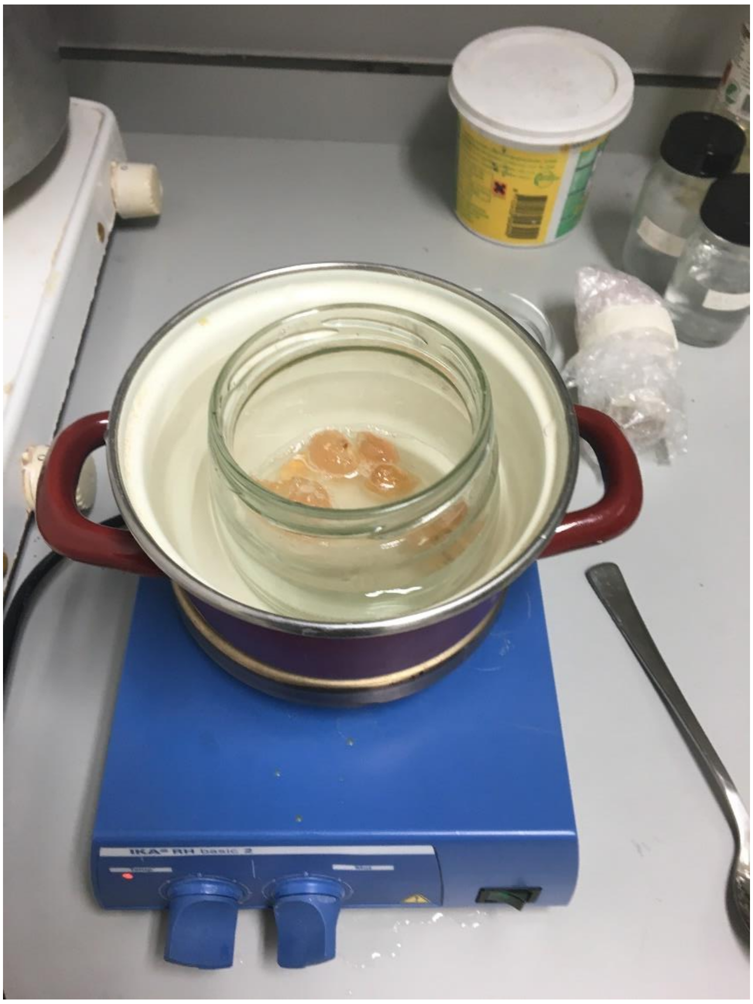

Figure 6: Melting the gum Arabic. Photo credit: Suzanne Bul.

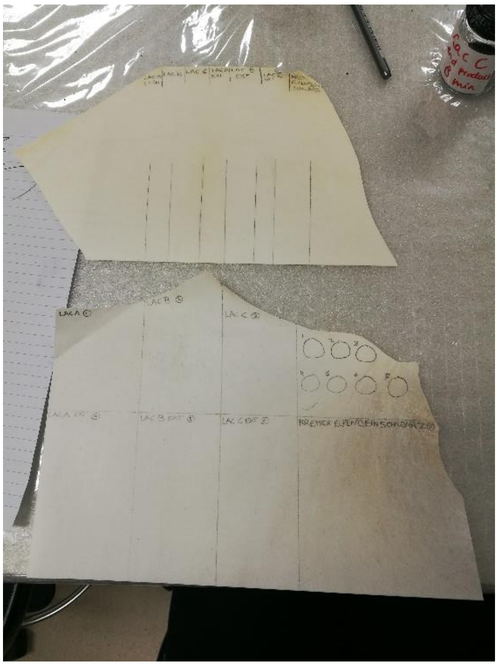

Figure 7: Parchment samples prior to painting. Photo credit: Jan van Daal.

Figure 8: Washed sticklac on paper towels. Photo credit: Suzanne Bul.

Figure 9: Paint made with sticklac-black pigment and gum Arabic. Photo credit: Suzanne Bul.

4.3 Results

Preparatory phase of the experiment
In the washing and processing, the sticklac was left for one hour in a jar with 100 ml of water. Some of the particles sunk immediately and some floated. The washing did not seem to clean the sticklac that well, so we rubbed the sticklac and drove off as much dirt as possible. There was no visible difference between the three different processed sticklac.

Experiment 1: *'as beautiful as ivory black'*

In firing the first batch (figure 10), we did not know how long it would take for the sticklac to catch fire and how long before the fire would extinguish by itself. The amount of time it took for the sticklac to catch fire inside the crucible varied between approximately two and ten minutes. The time of the actual burning of the resin varied between five and eleven minutes.[28] After the crucible had cooled down, we opened to see the outcome. Black shimmering shards had formed, like a melted substance that had solidified (figure 11). There was no visible difference between the appearance of Lac A, B, and C of the first attempt. In the additional firing round the amount of time it took for the resin to catch fire fluctuated between two and eight minutes.[29] The time burning for this round differed between six and eight minutes. There was no visible difference in firing the material any longer after the fire inside had extinguished. The substance in the crucible in all cases was of a metallic colour and had a glass-like structure. The grinding of the material was therefore more difficult and required more force in order to obtain a fine, powder-like pigment (figure 12). The pigment of Lac A of the first firing mixed rather well with the gum Arabic dissolved in water, as well as Lac B and C of the first round (figure 13). No colour differences were noticeable with the naked eye (figure 14). And there were no discrepancies in the 'dekkingskracht' of all three. The texture was rather good and could be easily adjusted by the addition of water to the mixture. This allowed for a better smearing quality and the paint adhered well to the parchment we used.

The three substances of the second firing were visually equal to those of the first firing. In grinding the solidified and carbonized resins, one was more difficult to grind, namely Lac C. There was an impurity present that had not completely burnt in spite of the additional firing. The pigment therefore turned out differently from both A and B, which were identical. Pigment C of the second had a more brownish tone, whereas all the other pigments were consistently black and equal in tonality. The pigments of the second firing had similar handling properties as those of the first firing. The mixing and preparing of the paint with the gum Arabic water solution was exactly the same as the those of the first firing. The addition of water enabled to make a smoother paint like in the first batch. The smearing and the 'dekkingskracht' were equal to that of the first firing round.

We compared the pigments A, B and C of both the first and second firing round to the Elfbeinschwarz, the synthetic variant of ivory black. Even though the pigment was ground more finely, there was no noticeable difference in texture when mixing the paint. It did not provide a finer paint than for example the other paints we made from the pigments. As well as the smearing and the handling of the paint was more or less equal to those paints with the homemade pigments. We rounded off this experiment by mixing one of the homemade pigments with water, however, the pigment did not blend well with water (figure 15). The pigment was suitable to be mixed with oil (figure 15). Nevertheless, the pigment mixed best with the gum Arabic water solution.

Table 1: The burning times of the sticklac, first attempt. Table made by Suzanne Bul.

Lac	**Type of crucible**	Start time firing the crucible	Time of sticklac catching fire	Time of sticklac fire extinguished & end time
A	large	09:44	09:52	10:00
B	large	09:31	09:41	09:53
C	small	10:00	10:03	10:08

[28] See Table 1.
[29] See Table 2.

Table 2: The burning times of the sticklac, firing for an additional 4 minutes, second attempt. Table made by Suzanne Bul.

Lac	**Type of crucible (small/large)**	Start time firing the crucible	Time of sticklac catching fire	Time of sticklac fire extinguished	End time firing
A	small	11:06	11:08	11:14	11:18
B	small	10:15	10:18	10:26	10:30
C	large	10:43	10:51	10:59	11:03

Figure 10: Suzanne burning the sticklac. Photo credit: Jan van Daal.

Figure 11: Opening the crucible after burning the sticklac. Photo credit: Jan van Daal.

Figure 12: Grinding the burnt sticklac. Photo credit: Suzanne Bul.

Figure 13: Painting with the sticklac-black mixed with gum Arabic and water. Photo credit: Suzanne Bul.

Figure 14: End result of the paint samples. Paint made with modern 'ivory black' is visible at the paint stripe most on the right and in the bottom right corner. Photo credit: Jan van Daal.

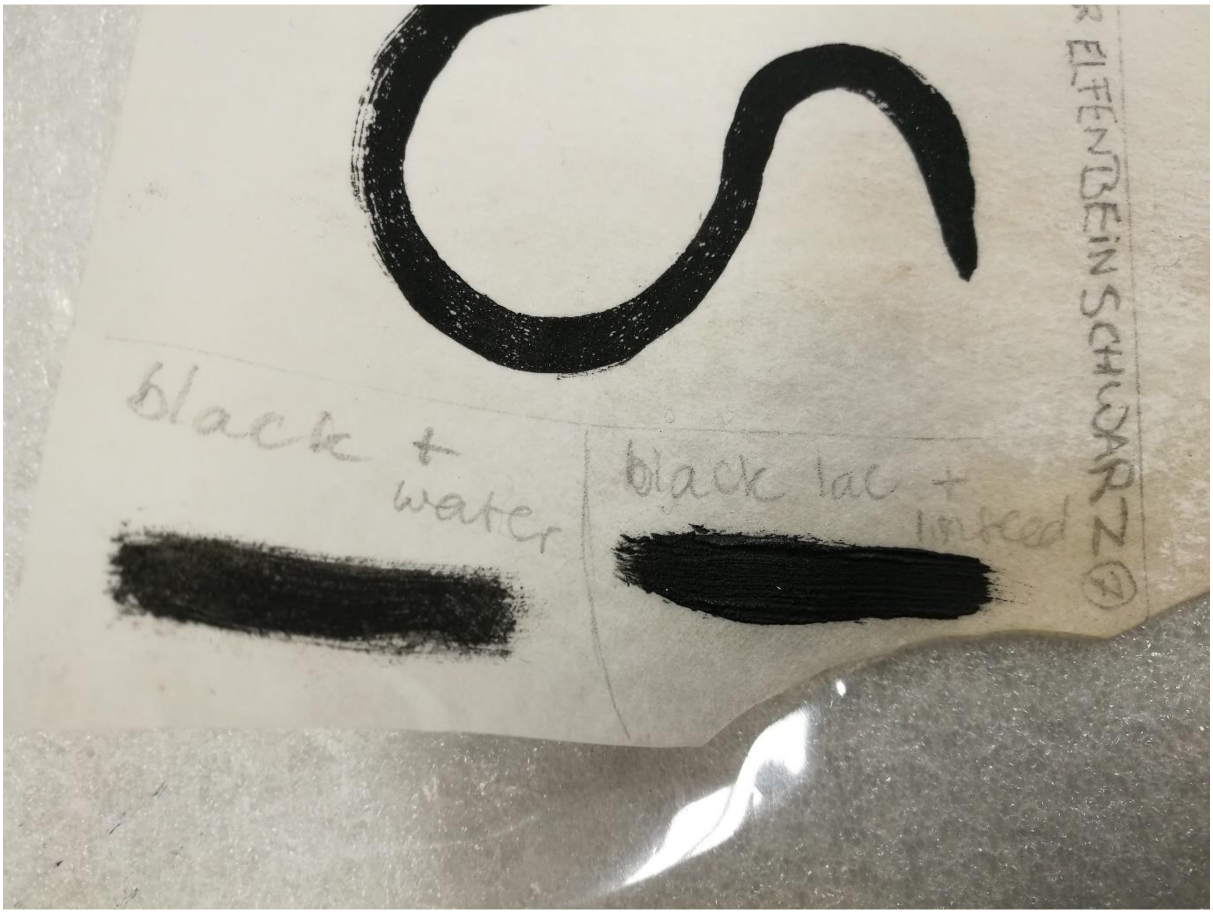

Figure 15: Sticklac-black mixed with water (left) and with oil (right). Photo credit: Jan van Daal.

4.4 Discussion

Sticklac-black is created by burning. Hence, the process of carbonization is inadmissible in understanding the process of producing a black pigment from a resin secreted by insects. The sticklac (CH3CH2CH2(CHOH)(CH2)7CHOH·COOH) was burned with a blowtorch fuelled by natural gas at a temperature between 900 and 1500 °C (figure 10).[30] Thus ensued a chemical reaction during which the organic materials present in the sticklac either carbonized or evaporated. This evaporation of organic materials was most likely noticed as the incense-like fragrance that was released coinciding with the organic material catching fire.

The sticklac in the smaller crucibles catching fire within approximately 1/3rd of the time it took for the sticlac in the larger crucible to catch fire corresponds with the smaller crucibles being approximately 1/3rd of the size of the larger crucible. The sticklac that was burned for an additional four minutes did not have different optical properties than the sticklac burned until the flames from within the crucible subsided. This is arguably because of the absence or negligible presence of remaining organic material to be burned. The flames from within the crucible subsiding can therefore be interpreted as indication of complete carbonization of the

[30] The exact temperatures of the flame during each individual burning session are unknown. This is due to the absence of a built-in heat indicator on the one hand, and on the other hand because three people took turns operating the blowtorch, inevitably leading to discrepancies in amounts of natural gas and pressurized oxygen used. The estimate of 900 to 1500 °C is based on information about temperatures of natural gas-fuelled flames found on the World Wide Web.

resin.

When the crucible was opened the contents were reminiscent of foam and surprisingly glossy (figure 11). The glossy, almost metallic appearance of the burnt sticklac was not anticipated since the pigment would have to be a dull black to be comparable to ivory black. Grinding the burnt sticklac with mortar and pestle however resulted in the anticipated dull black pigment. The insides of crucibles were covered in a similar glossy soot, which was impossible to clean off either mechanically or with the assistance of tap water. The explanation for this phenomenon proposed below argues an interaction between the resin, the burning method and the crucible.

In the introduction to the present experiment it has been argued that sticklac and shellac are the same material, only with the latter being a purified version of the former. Therefore, data for shellac is deemed representative in the absence of specific data for sticklac. Heating shellac results in carbonization and generation of flammable gas, with its melting point being around 120 °C and the temperature of initial blackening around 180 °C.[31] Identical glossy soot that could not be washed off is known from (ethno-)archaeological ceramic vessels.[32] As is apparently the case with the crucibles, the glossy soot has penetrated into the ceramic walls of these vessels after burning.[33] While the formation process of glossy soot is not completely understood, it is clear that the glossiness is a result of droplets of resin sometimes present in firewood solidifying on a relatively cool ceramic surface.[34]

Burning shellac starts with the resin melting and forming bubbles.[35] The flame generated by the blowtorch was unable to cover the entirety of a crucible and therefore had to be moved occasionally to ensure that every part of the crucible was heated. Moving the flame must have inadvertently led to parts of the crucible becoming relatively cool, which would have allowed for partial solidification of the bubbly sticklac.[36] Repeated melting and cooling of the bubbly sticklac is a plausible explanation for its foamlike structure after burning. The glossiness is most likely because of the same mechanical interactions between resin, heat source and vessel as explained by Beck 2010 and Skibo 1992. The initial glossiness of the burnt sticklac being unrelated to the resin's composition explains the immediate disappearance of any gloss after grinding.

Between five of the six varieties of the sticklac-black no discrepancies in colour were visible (figure 14).[37] This is arguably because of the influence of different washing and burning times having a negligible impact on the composition of the end product. There was no visible colour-difference between the sticklac-black and the modern 'ivory black'. It is plausible that this optical similarity is because both pigments belong to the same sub-group of carbon-based black pigments. Following the classification in the *Pigment Compendium* this would be the cokes sub-group, which is defined as "[…] any carbonized product for which the precursor was in a liquid or plastic state immediately before carbonisation […]".[38]

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[31] Kosanke *et al*. 2012: 998; this flammable gas is possibly the gas causing both the incense-like smell and the flames from within the crucible.
[32] Beck 2010: 50-51.
[33] *Ibidem*: 51.
[34] *Ibidem*: 51; Skibo 1992: 162.
[35] Rich 1988: 71.
[36] The notion of significant temperature changes as result of the burning method is further supported by one half of the large crucible suddenly breaking in two at the end of the burning sessions (image).
[37] The only exception was the slightly brownish tone of pigment C, which is the result of an unburnt impurity having been accidentally ground up with the pigment.
[38] Eastaugh *et al*. 2008: 90.

Finally, the combination with binding media resulted in the observation that the pigment did not bind well with water (figure 15), reasonably well with linseed oil and best with the mixture of water and gum Arabic. Why this is, is not understood at present. Considering a complete absence of publications on sticklac-black, answering this question would require additional research. The handling properties of sticklac-black as paint were not different from those of modern 'ivory black'. While the recipe states that sticklac-black should have superior 'body', limitations in time prevented in-depth research of the paints' 'bodies'.[39] While designated testing of 'body' would be an improvement for future experiments, the conclusion that can be derived from this experiment is that sticklac-black is in no way inferior to modern 'ivory black' when it concerns handling properties as paint.

4.5 Conclusion

Burning sticklac in a closed crucible until the point of complete carbonisation leads to a glossy black substance which upon grinding becomes a dull and intense black pigment. Variating with degrees of washing and extended burning time after complete carbonisation did not lead to observable differences between pigment varieties. Therefore, it can be concluded that extended burning times and cleaning actions that go beyond the manual removal of large impurities are unnecessary to successfully produce sticklac-black.

Sticklac-black can be used in combination with both oil- and water-based binding media but based on the experimenters' tactile experience, a mixture of gum Arabic and water yields superior results. The paint made with sticklac-black was optically identical to the paint made with modern 'ivory-black'. It is therefore possible to corroborate the hypothesis that John Hoskins was correct in stating that it is possible to create a black pigment identical to ivory black, by burning sticklac.

Due to limitations in time and painting experience on the experimenters' side it is impossible to corroborate Hoskins' statement that sticklac-black has superior 'body' when compared to ivory black. The experimenters however did not notice any difference in handling properties between paint made with sticklac-black and paint made with ivory-black, so it is possible to corroborate this final part of the hypothesis to some extent with the proposition that sticklac-black is at least as good as ivory black when it comes to 'body'.

[39] A possible method for testing 'body' in a future experiment would be add equal amounts of binding medium to equal amounts of pigment and paint stripes of equal length and width to determine which paint lasts longer and thus has superior 'body'.

5.1 Introduction experiment 2

On folio 21 verso of the De Mayerne Manuscript one can read a concise recipe to create what De Mayerne calls Indian varnish. As was the case in experiment 1 De Mayerne names "laque" from the Indies as key raw material. For the current experiment as well as for the previous experiment, this substance is argued to be sticklac.

Processing sticklac by cleaning and heating results in a resinous substance that has several uses. The product obtained by letting this resin cool in the shape of flakes is called shellac.[40] Shellac can be liquified into a varnish which historically has been used mainly as (re)finish for wooden surfaces.[41] In this recipe De Mayerne does not mention any form of heat-treatment of the resin. Furthermore, according to De Mayerne this varnish can be used on any type of object. According to De Mayerne the varnish is made by dissolving the resin in oil of spike lavender (*Lavendula latifola*). A side note by De Mayerne himself does not only mention that this varnish is made by cold temperatures, but also hypothesizes that dissolving the resin might be aided by the addition of ethanol to the mixture.

The goal of this experiment is twofold. On the one hand the goal is to corroborate De Mayerne's statement that a varnish can be produced by the aforementioned method. On the other hand, the goal is to establish whether his proposition of ethanol as an aid in dissolving the sticklac is correct. Consequently, the hypothesis for this experiment is twofold as well: a varnish can be produced by dissolving sticklac in oil of spike lavender without the aid of heat and adding ethanol to this mixture should accelerate dissolving the sticklac.

5.2 Experimental set-up

Materials for experiment 2: *'the Indian varnish'*.

- Prepared Lac A, B, C (figure 16)
- 6 larger jars (figure 16)
- Spike lavender oil[42] (figure 17)
- Nitrile gloves
- Ethanol (figure 16)
- Pipet (figure 16)
- Scale
- Changeant-like synthetic fabric
- The parchment with the paint samples from experiment 1.

In coming up with a workplan there was only one obstacle, the matter of quantity. Since De Mayerne had given no indication of quantity and no mention of heating the oil. Therefore, staying true to the recipe and not heating the oil was a fairly logical option. There was no clear idea on the ratio natural resin solvent for the varnish. We decided to use equal volume parts of 1:1 ratio. The dark and cool place we decided was the Paintings Conservation Studio of the UvA, since it is dark 16 hours a day and is cool. This translated into the following workplan:

[40] Horie 2010: 258.
[41] *Ibidem*: 258-259.
[42] Bought at Van Beek Art Supplies.

1. Grab the large jar. Measure first 5 grams Lac A (in grams) and 10 ml spike lavender oil and put in the large jar. Gently shake the jar so the surface of the resin is covered with lavender spike oil. And leave it for a week in a dark and cool place.
2. Repeat this process for Lac B and Lac C.
3. Grab the mixing beaker. Measure first 5 grams Lac A (in grams) and 10 ml lavender spike oil. And add 10 ml of ethanol to the mixture. And leave it for a week in a dark and cool place.
4. Repeat Step 3 for Lac B and C.
5. Pass the varnish A through the cloth.
6. Apply over half of the paint samples on the parchment, with your fingers and a brush.
7. Repeat step 5 and 6 for varnish B, C, A with ethanol, B with ethanol and C with ethanol.

Figure 16: Overview of the sticklac-setup, solvents and other materials used. Photo credit: Jan van Daal.

Figure 17: Close-up photograph of the spike lavender oil. Photo credit: Jan van Daal.

Figure 18: Manually smearing the varnish over the paint samples made during experiment 1. Photo credit: Jenny Boulboullé.

5.3 Results

Experiment 2: *'Indian varnish'*
In mixing the varnish there was a sticklac and lavender spike oil variant, as well as a sticklac – spike lavender oil with ethanol variant. After having put in the resin with the solvent for all Lac A, B, and C, the varnish started to become brownish after a few minutes. The brown increased over two weeks' time and the varnish turned slightly thick in consistency. The resin had not dissolved in the solvent, but just lost some of its colour. There was no discernible difference between the handling of the varnish with your fingers or with a brush. The brush allowed more control in the smearing.

The other variant, containing one additional part of ethanol, of all Lac A, B and C turned brown more quickly than the first variant without ethanol in those first few minutes. This varnish during the two weeks turned browner, as well as that the resin had dissolved a lot more than with the varnish without the ethanol. It was slightly easier to smear (figure 18), since it was a thinner substance in comparison to the varnish without ethanol. It was equally easy to handle with both fingers and brush.

5.4 Discussion

The results during the varnish experiment can be explained by considering the solubility parameters of the solvents used to dissolve the sticklac. As has been argued before, sticklac (CH3CH2CH2(CHOH)(CH2)7CHOH·COOH) can be equated with shellac because the latter is nothing more than a cleaned variety of the former. This equation is beneficial due to the absence of chemical publications specifically dealing with sticklac.

A characteristic of shellac is that it is soluble in hydrogen-bonding solvents, of which ethanol is most commonly used.[43] This is made possible by the multiple O-atoms with lone electron pairs present in shellac molecules, which allow for interaction with hydrogen-bonding solvents (figure 19). The principle behind this phenomenon can be explained crudely with the phrase 'like dissolves like', which Velson Horie in *Materials for Conservation* defines as "the intuitive realization that the forces between the molecules of a good solvent must be as those between the molecules of a polymer".[44]

Information about the intermolecular forces of ethanol is readily available and has been included in table 3. No data for the intermolecular forces of spike lavender oil is available, so an estimate has been made by the present author. The method to create this estimate was to determine the major active components which on average can make up to 100% of the composition of spike lavender oil, find out the solubility parameters for these components and calculate the solubility parameters for spike lavender oil based on the relative proportions of its major components. It is important to note that the results are estimates based on averages. Spike lavender oil is a natural product, so the actual relative proportions of its components may vary between batches. This estimate however was necessary to interpret the results of the present experiment. Data for the relative proportions of the major active components within spike lavender oil has been obtained from Buckly-Smith 2006 and Shellie *et al*. 2002.[45]

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[43] Horie 2010: 258.
[44] *Ibidem*: 69.
[45] Buckly-Smith 2006: 87-88; Shellie *et al*. 2002: 227-231.

The data pertaining to the intermolecular forces within the solvents relevant for this experiment has been included in table 3. Table 4 shows the data pertaining to the relative proportions of the major active components within spike lavender oil, which was essential to establishing an estimate for the intermolecular forces within spike lavender oil. The Teas Fractional Parameters for the relevant solvents have been visualized in a ternary diagram (figure 20).

This diagram sheds light on the obtained results. It has been established that ethanol is a good solvent for shellac. Pure spike lavender oil was also successful as solvent for the sticklac, but less so, because hydrogen bonding forces are less influential than is the case in pure ethanol. A 1:1 mixture of ethanol and spike lavender oil results in considerably stronger hydrogen bonding forces than those in pure spike lavender oil. This solvent therefore leads to faster and more complete dissolving of the sticklac, and consequently a more dilute varnish.[46] The fact that pure spike lavender oil also functions as solvent for sticklac can be explained by the proposition that spike lavender oil can contain up to 72.5% active components in which hydrogen bonding forces are present (table 4).

It is plausible that the lack of difference between the varnishes based on the three stages in cleaning is because of the cleaning with tap water having no influence on the chemical composition of the sticklac. Allowing the sticklac-solvent mixture to stand for an increased amount of time might have led to complete dissolving of the resin. Due to limited time this was not possible but could be taken into consideration for future experiments.

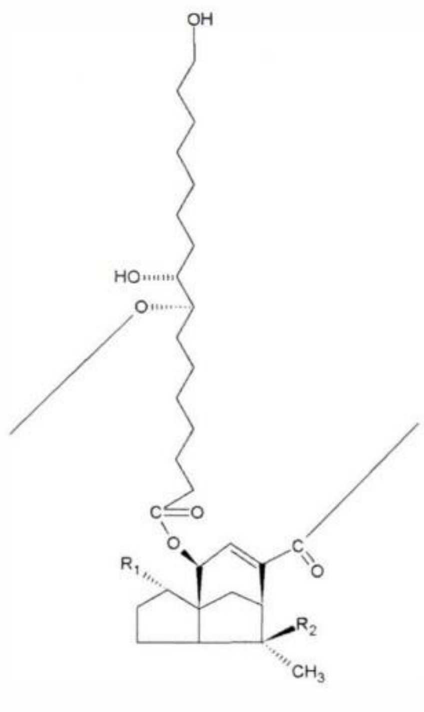

Figure 19: Schematic depiction of a shellac molecule. Figure copied from Horie 2010: 249.

[46] It should be noted that because the recipe specifically mentioned the *addition* of ethanol to the sticklac-spike lavender oil mixture, the choice was made to add ethanol instead of substituting it for a part of the spike lavender oil. Therefore, the solvent to resin ratio was greater than in the pure sticklac-spike lavender oil mixture. This may also have contributed to the faster dissolving of the sticklac and the more dilute varnish. An improvement for a future experiment could be to create a third varnish, in which the sticklac and the spike lavender oil-ethanol mixture are present in equal proportions.

Table 3: Hansen Solubility Parameters and Teas Fractional Parameters for the eight solvents relevant to the current experiment. The five major active components of spike lavender oil are depicted in cursive. Table made by the present author (Jan van Daal).

Solvents	**Hansen Solubility Parameters (HSP)**			**Teas Fractional Parameters (TFP)**[47]		
	Dispersion	**Polarity**	**Hydrogen bonding**	**100f_d**	**100f_p**	**100f_h**
Ethanol[48]	15.8	8.8	19.4	36	20	44
1:1 Ethanol : Spike lavender oil[49]	16.1	6	12.7	50	16.5	33.5
Spike lavender oil[50]	16.3	3.2	5.9	64	13	23
Linalool[51]	*16.3*	*4.4*	*11.2*	*51*	*14*	*35*
Camphor[52]	*16*	*0*	*0*	*100*	*0*	*0*
Eucalyptol[53]	*16.7*	*4.6*	*3.4*	*67.5*	*18.5*	*14*
α-pinene[54]	*16.4*	*1.4*	*0.4*	*90*	*8*	*2*
Linalyl acetate[55]	*14.3*	*1.5*	*6.2*	*65*	*7*	*28*

Table 4: Estimates average relative proportions of the five major active components in spike lavender oil. Estimates are based on Buckly-Smith 2006: 87-88 and Shellie *et al*. 2002: 227-231. Table made by the present author (Jan van Daal).

Major active components in spike lavender oil	**Estimated average relative proportions**
Linalool	45%
Camphor	27.5%
Eucalyptol	25%
α-pinene	2%
Linalyl acetate	0.5%
Total	**100%**

[47] Calculated by the present author based on HSP.
[48] HSP obtained from Horie 2010: 348-349.
[49] HSP calculated by the present author.
[50] HSP calculated by the present author.
[51] HSP obtained from García *et al*. 2009: 1816.
[52] HSP obtained from Horie 2010: 244-245.
[53] HSP obtained from Hansen 2007: 380.
[54] HSP obtained from Horie 2010: 244-245.
[55] HSP obtained from Buckly-Smith 2006: 89.

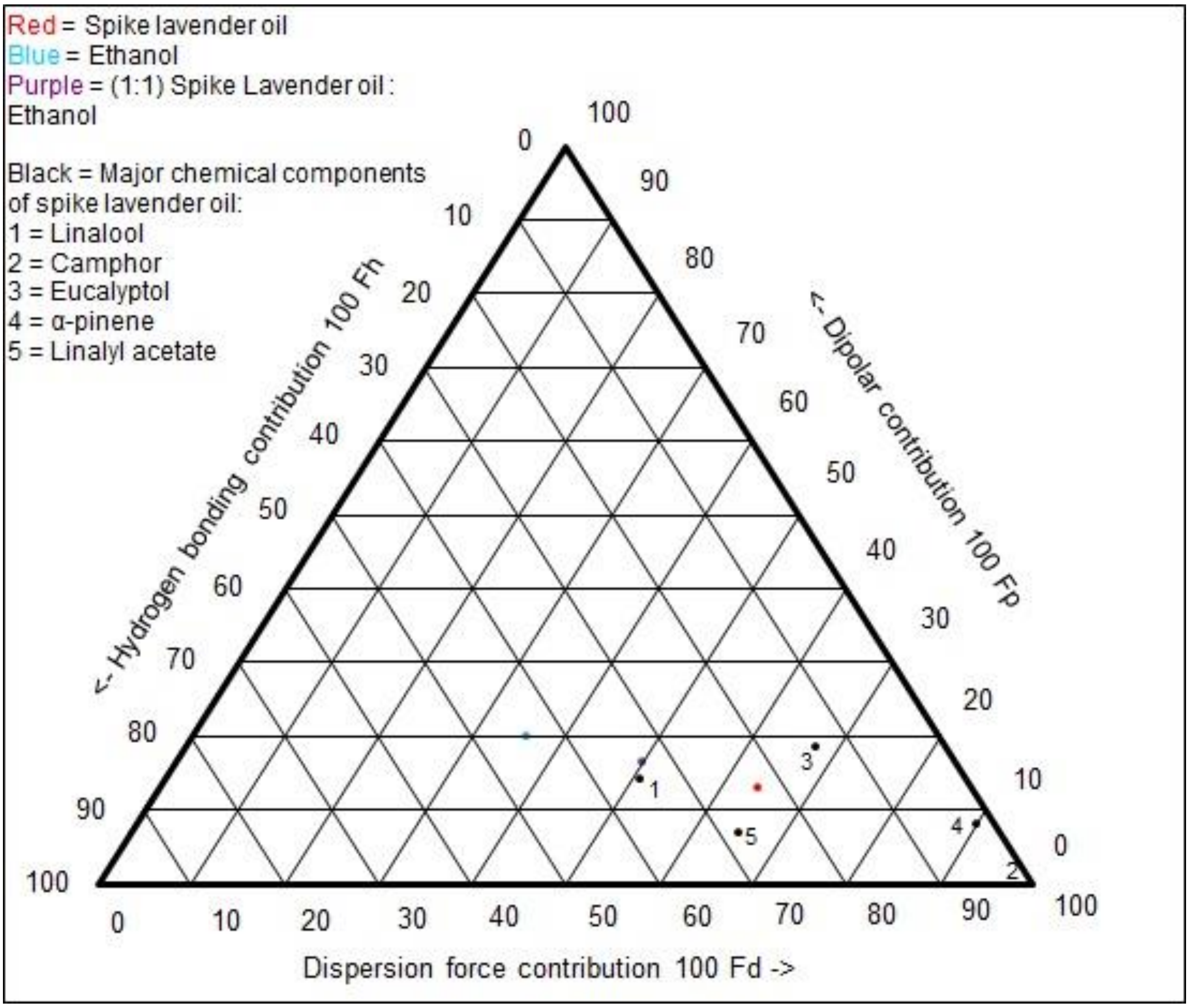

Figure 20: Ternary diagram showing the Teas Fractional Parameters for the solvents relevant to the current experiment. Figure made by the present author (Jan van Daal) using the Tri-plot Microsoft Excel spreadsheet developed by Loughborough University.

5.5 Conclusion

Allowing sticklac that has been divided into three gradations of cleanness to dissolve in oil of spike lavender and a 1:1 mixture of spike lavender oil and ethanol for two weeks resulted in a varnish that could be applied successfully with fingers on the paint samples made during the first experiment (figure 21). After two weeks, both varieties of varnish contained undissolved resin. Allowing the varnish to stand for an extended period might have resulted in the resin dissolving completely.

The dissolving of the sticklac, which dissolves in solutions in which hydrogen-bonding forces are present, was more successful in the solution containing ethanol. The main factor contributing to this result was the increase in hydrogen-bonding forces caused by the ethanol. Another factor that should be taken into consideration is that the solvent to resin ratio in the mixture containing ethanol was greater than in the pure resin-oil mixture. The choice to add ethanol was however made consciously by the experimenters because the recipe called for an addition of ethanol and not a substitution.

Even when the varnish applied over the paint samples was dry, the black paint over which the varnish was applied looked more saturated than the paint lacking a varnish layer (figure 22). Thus, the varnish can be successfully used, which validates the hypothesis that a varnish can be produced by dissolving sticklac in oil of spike lavender without the aid of heat. The fact that the resin in the solution containing ethanol had dissolved more completely validates the hypothesis that adding ethanol to the resin-oil mixture accelerates the dissolving of the sticklac.

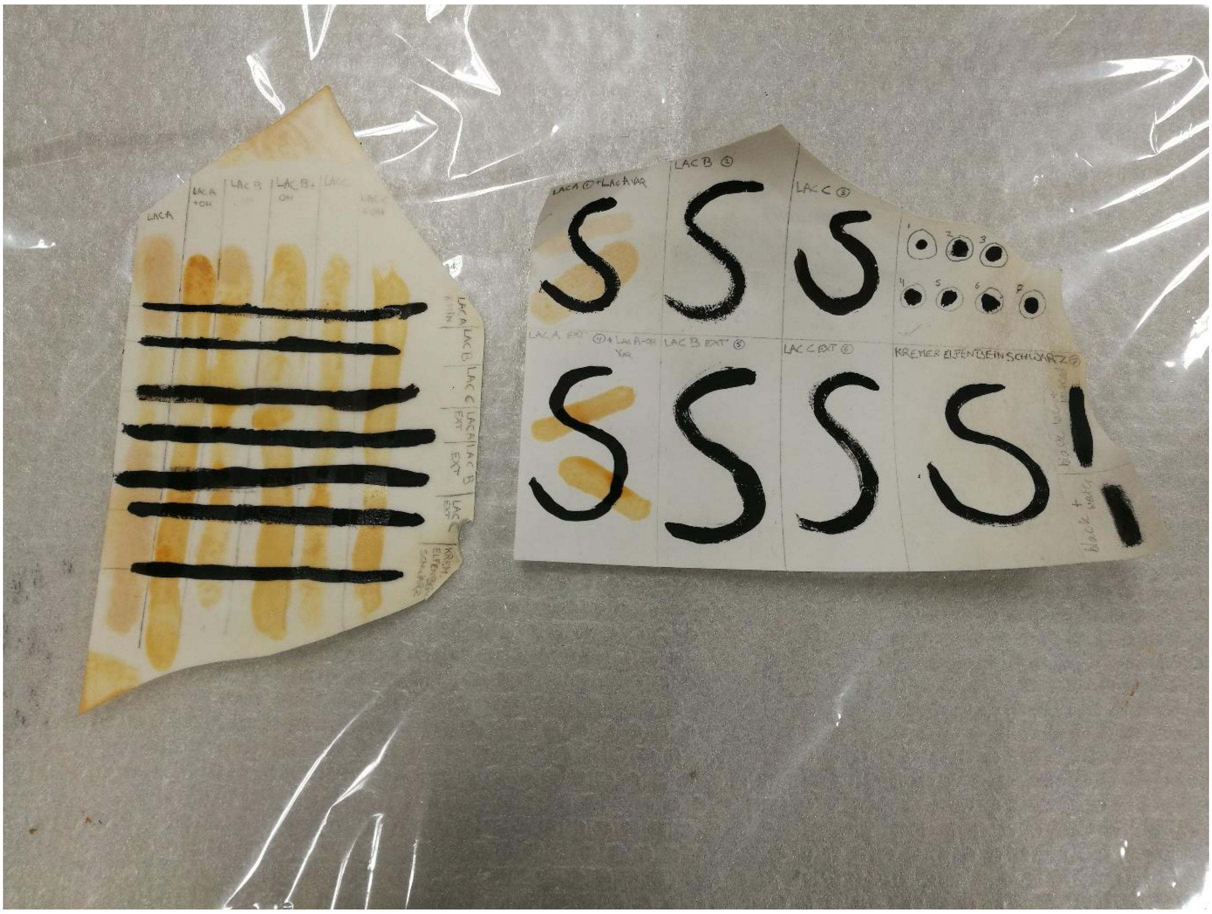

Figure 21: Layers of varnish over the paint samples made during experiment 1. Photo credit: Jan van Daal.

Figure 22: Detail photograph showing the difference in saturation between paint samples with and without varnish layer. Photo credit: Jan van Daal.

6. General conclusion

The execution of the two experiments can be described as successful. The experimenters were able to validate both hypotheses, which leads to the conclusion that both recipes are workable. It is also worthwhile to mention that even though both recipes were workable, they were far from complete. Quite a lot of tacit knowledge was necessary to grasp what was being said exactly. Notable examples were the degree to which the sticklac should be cleaned before processing and the amount of burning time required to create the perfect sticklac-black. By creating different varieties of sticklac-black and sticklac-based varnish the experimenters acquired a great deal of tacit knowledge which would have been commonplace for artists in De Mayerne's era. However, if this tacit knowledge had been present from the beginning, a more in-depth way of conducting the experiments would have been possible.

Lastly, translating the recipes was a worthwhile exercise in understanding what exactly was being said by De Mayerne. This exercise in translation sparked an awareness that even published translations are prone to grave error. It is therefore essential to always return to the source text when reconstructing historical recipes.

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Bibliography

Beck, M.E. 'Ceramic Vessel Use and Use Alteration: Insights from Experimental Archaeology.' In: J.R. Ferguson, ed. *Designing Experimental Research in Archaeology. Examining Technology Through Production and Use*. Boulder CO: University Press of Colorado, 2010: 47-70.

Buckley-Smith, M.K. *The Use of Solubility Parameters to Select Membrane Materials for Pervaporation of Organic Mixtures*. Hamilton NZ: The University of Waikato (Ph.D. thesis The University of Waikato), 2006.

Eastaugh, N., V. Walsh, T. Chaplin and R. Siddall. *Pigment Compendium. A Dictionary and Optical Microscopy of Historical Pigments*. Amsterdam etc.: Elsevier, 2008

Fels, D. *Lost Secrets of Flemish painting: including the first complete English translation of the De Mayerne manuscript, B.M. Sloane 2052*. Floyd (VA): Alchemist, 2004.

García, M.T., I. Gracia, G. Duque, A. de Lucas and J.F. Rodríguez. 'Study of the solubility and stability of polystyrene wastes in a dissolution recycling process.' *Waste Management*, 29(6) (2009): 1814-1818.

Hansen, C.M. *Hansen Solubility Parameters: A User's Handbook. Second Edition*. Boca Raton etc.: CRC Press, Taylor & Francis Group, 2007.

Horie, V. *Materials for Conservation: Organic consolidants, adhesives and coatings. Second edition*. Amsterdam etc.: Elsevier, 2010.

Kosanke, K.L., B.J. Kosanke, B.T. Sturman and R.M. Winokur, eds. *Encyclopedic Dictionary of Pyrotechnics (and Related Subjects). Part 3 – P to Z.* Whitewater CO: Journal of Pyrotechnics, Inc., 2012.

Norgate, E. *Miniatura or the art of limning*. J.M. Muller & J. Murrel, eds. New Haven: Yale University Press, 1997.

Reynolds, G. *English Portrait Miniatures*. Cambridge: Cambridge University Press, 1988.

Rich, J.C. *The Materials and Methods of Sculpture*. New York: Dover Publications, Inc., 1988[10] (1947)

Rinaldi, S. *Pittura, scultura e delle arte minori 1620-1646: ms. Sloane 2052 del British Museum di Londra*. Anzio: De Rubeis, 1995.

Shellie, R., L. Mondello, P. Marriott and G. Dugo. 2002: 'Characterisation of lavender essential oils by using gas chromatography–mass spectrometry with correlation of linear retention indices and comparison with comprehensive two-dimensional gas chromatography.' *Journal of Chromatography A*, 970(1-2) (2002): 225-234.

Skibo, J.M. *Pottery Function. A Use-Alteration Perspective*. New York: Plenum Press, 1992.

Ward, G.W.R. *The Grove encyclopedia of materials and techniques in art*. New York: Oxford University Press, 2008.

Appendix I: field notes

Sticklac: the raw sticklac comes in reddish-brown clumps, shaped like what can be expected of a natural resin. Its smell can best be described as musty. The raw sticklac still contains impurities such as small sticks and pieces of bark. Most of these impurities can be removed manually and by washing the sticklac under cold tap water. Manipulating the sticklac during washing leads to the larger particles breaking down.

Burning the sticklac took place in a closed crucible, so it was not possible to see how the sticklac reacted to heat. However, after burning the sticklac for a few minutes an incense-like smell became noticeable. This more or less coincided with flames emanating from the crucible, indicating that the sticklac caught fire. After the sticklac had carbonised fully, the inside of the crucible was coated in a glossy black soot that could not be washed off. The burned sticklac itself had the same glossy black hue. It had the texture of solidified foam and had considerably less weight than the unburnt sticklac.

Sticklac-black: Grinding the burnt sticklac with mortar and pestle took considerable effort but resulted in a fine pigment. As opposed to the glossy foam and soot, the pigment was dull and intensely black.

The pigment was easily miscible with gum Arabic and water. It should be noted that melting the solid gum Arabic took considerable time, so this is something to take into account for future experiments. The paint made with sticklac-black was smooth and easy to handle with a brush. It had good opacity, thus eliminating the need for multiple applications to create an opaque black layer. Mixing the sticklac-black with linseed oil also gave satisfactory results. It did not mix very well with tap water and thus did not result in the immediate opacity that could be achieved with gum Arabic and linseed oil.

Sticklac-based varnish: both varieties of varnish (with and without ethanol) were made with oil of spike lavender. The oil had a strong lavender smell which managed to penetrate even through the fume cabinet when the materials were left there to evaporate prior to cleaning. Prolonged exposure to the pure oil of spike lavender can be somewhat unpleasant due to its intense aroma.The sticklac resulted in a varnish that was brownish in colour. The varnish with ethanol was more dilute and the sticklac had dissolved better than was the case in the pure spike lavender oil. Both varnishes contained undissolved resin after two weeks. This was easily sieved out.

Both varnishes were easy to handle with fingers. The varnish without ethanol was thicker (comparable to the consistency of olive oil) and felt smooth on the fingers. The varnish with ethanol was more dilute and therefore more prone to drip from the fingers than the varnish made with pure spike lavender oil. It was also possible to utilize a brush instead of fingers, but the brush created a thinner layer of varnish than the fingers. It should be noted that after use for a varnish the brushes had to be disposed of and is therefore a more wasteful method than the method using bare fingers.

Appendix II: safety, waste & maintenance protocols

Safety protocol:

- handling the burner, we wore leather aprons, safety goggles and leather gloves. This took place in the welding and soldering department in a controlled environment.
- handling the varnish making we used nitrile gloves and the fume hoods in the painting conservation studio

Info- and safety data sheets

Ivory black Kremer:
<< http://www.kremer-pigmente.com/en/pigments/kremer-made-and-historic-pigments/198/ivory-black-genuine >> (scroll down for info sheet and msds)

Sticklac Kremer:
<< http://www.kremer-pigmente.com/en/mediums-binders-und-glues/solvent-soluble-binders/natural-resins/2032/stick-lac >> (scroll down for info sheet and msds)

Spike lavender oil:
<< http://www.kremer-pigmente.com/en/mediums-binders-und-glues/oils/essential-oils/2283/spike-lavender-oil >> (scroll down for info sheet and msds)