Note from the Making and Knowing Project:

This essay was written for “The Art Technological Source,” an 8-week graduate course at the University of Amsterdam offered by Dr. Marjolijn Bol in 2015 and 2016 to students enrolled in an MA program in either Technical Art History or Conservation and Restoration. Students worked on various recipes from BnF Ms. Fr. 640 on the following five topics: 1) tracing and painting on glass, 2) yellow dyes and their applications, 3) dragon’s blood, 4) painters’ varnishes, and 5) sieves.

This is an un-edited student paper that relies on an earlier state of the Making and Knowing Project’s transcription and translation of Ms. Fr. 640. For an updated version of the text, see:

> Making and Knowing Project, Pamela H. Smith, Naomi Rosenkranz, Tianna Helena Uchacz, Tillmann Taape, Clément Godbarge, Sophie Pitman, Jenny Boulboullé, Joel Klein, Donna Bilak, Marc Smith, and Terry Catapano, eds., *Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640* (New York: Making and Knowing Project, 2020), https://edition640.makingandknowing.org. DOI: https://doi.org/10.7916/78yt-2v41.

“Drenched in Varnish”

The Role of the Penetrating Aspect of Aspic Oil as a Varnish Component within the Manuscript BnF Ms. Fr. 640

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Transcription

<title id="p056r_a2">**Vernis** pour destrempe</title>

<ab id="p056r_b2">Tu peulx fayre du **mabre** à destrempe de **laque** ou **rose<lb/>**
de <u>Gand</u> & de **croye**. Estant sec, glacer de **laque** destre[mpée]<lb/>
en **vin**, car la **colle** la faict mourir & noircir. Et tout se mo{n}st[rera aprés]<lb/>
rouge, mays le **vernis** que tu y mettras qui penetrera fera<lb/>
monstrer obscur & clair ce qui le debvra estre. Le **vernis**<lb/>
se faict, ainsy: mesle avecq **tourmentine claire de <u>Venise</u>**<lb/>
de l'**huile d'aspic** jusques à ce que le tout soit assés cler<lb/>
& liquide, & il se faict sans feu. Cestuy cy est pour<lb/>
les choses à destrempe, et le **vernis de tourmentine** que<lb/>
tu sçais pour les tableaux. Le **vernis pur d'aspic** n'est<lb/>
pas bon pour les tableaulx, car l'**huile d'aspic** est trop<lb/>
penetrant & faict petiller les couleurs s'il n'est de long temps<lb/>
faict.</ab>

Translation

<title id="p056r_a2">**Varnish** for tempera</title>

<ab id="p056r_b2">You can make **tempera marble** with **lacquer** or **rose of <u>Ghent</u>** and **chalk**. Once dry, glaze it with **lacquer** mixed with **wine**, for **glue** will dull and blacken it. And the whole will firstly appear red, but the **varnish** you will apply, which will penetrate it, will make dark and light parts appear as they should. The **varnish** is made like this: mix with clear **<u>Venice</u> turpentine** some **aspic oil** until it becomes clear and liquid, and this is done without fire. This is for things done in tempera, and the **turpentine varnish** that you know is for panel paintings. Pure **lavender spike varnish** is not good for panel paintings because **lavender spike oil** is too penetrating and makes colours shine unless it has been made long beforehand.</ab>

Introduction

This report is a contribution to the 'The Making and Knowing Project: reconstructing the sixteenth-century workshop of BnF Ms. Fr. 640 at Columbia University' directed by Prof. Dr. Pamela Smith. The late sixteenth-century French manuscript 'BnF Ms. Fr. 640' is comprised of 170 folios and now resides in the Bibliothèque Nationale in Paris, and furthermore, has been digitized.[1] The manuscript's author-practitioner recorded his techniques and recipes, which involve a wide range of subjects.[2]

The Art Technological Research Group was established with the aim to develop a methodology to research sources of materials, tools and techniques. As part of the course 'Art Technological Source', a historical reconstruction of the art technological recipes from the BnF Ms. Fr. 640 manuscript were made. Samual Johansson, Sepha Wouda and I reconstructed fol. 56 'Varnish for tempera'. When reconstructing the recipe as historically accurate as possible, several difficulties arose. Various ingredients needed to be considered, different amounts of the ingredients were tested and different application methods were used.[3] Each of us investigated a difficulty regarding fol. 56.

Research into art technological sources is of great importance for me as a future conservator of paintings. The mechanical behavior of materials is always considered in conservation treatments, which lends this research to be of both relevance and importance.

My annotation investigates the role of the penetrating aspect of aspic oil as a varnish component within the manuscript BnF Ms. Fr. 640. Aspic oil, in conjunction with Venice turpentine, form the tempera varnish of the reconstructed folio. The translated manuscript uses the following names to indicate the same essential oil: 'aspic oil', 'spike oil', 'lavender oil', and 'lavender spike (oil)'.[4] In order to improve this work's readability, I only use the term 'aspic oil'. The manuscript mentions aspic oil 20 times, in folios with varying subjects. These subjects, together with additional sources, critical literature, and reconstructions, are combined to investigate the aspic oil's penetrating aspect as well as its role.

Firstly, as there are different brands and types of aspic oil available, it is necessary to determine which aspic oil would be most historically similar to the sixteenth-century oil, before this study investigates its ability to penetrate. Subsequently, this study examines its penetrating aspect through the application of the reconstructed tempera varnish on different supports: both on

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[1] <www.makingandknowing.org>, accessed on 10-03-16.

[2] These subjects include drawing-instruction, pigment-making, metal-coloring, counterfeit gem production, life-casting in metal, cannon-casting, tree-grafting, land-surveying, a practice of taxidermy to manufacture monstrous composite animals (kittens and bats), making paper mâché masks, and much more. <www.makingandknowing.org>, accessed on 10-03-16. Further on in this annotation, the author-practitioner will be called 'author' to improve the readability of the text.

[3] Besides uncertainties within fol. 56, the tempera marble reconstruction of the other group, which would serve as substrate, also played a role as to whether the tempera varnish would work historically accurately.

[4] The original French text describes the essential oil as 'huile d'aspic', which can be translated to both 'aspic oil' and 'lavender spike oil', see: http://www.micmap.org/dicfro/search/century-dictionary/aspic, accessed on 10-03-16.

bare wood and on a tempera marble reconstruction, with and without a glue isolation layer. Finally, the conclusion provides the results of the research.

Defining the most historically accurate aspic oil

In the reconstruction of a recipe from art technological sources like the BnF Manuscript, one must first justify their decisions concerning certain materials and methods. The assessed methods include what materials comprise the end product, where the materials were sourced and what determines their quality. Fol. 56 lends only minimal information to answer these questions: "*The varnish is made like this: mix with clear Venice turpentine some aspic oil until it becomes clear and liquid, and this is done without fire.*"[5]

Aspic oil, like oils of turpentine, has been known since the beginning of the sixteenth-century.[6] The aspic oil operates as a solvent for the Venice turpentine in fol. 56.[7] The oil is obtained from the distillation of spike lavender (Lavendula spica or Lavendula Latifolia) and is a colorless liquid.[8] Lavendula Latifolia, normally 30-60 cm in height, grows in the wild in the Mediterranean regions of the former Yugoslavia, Italy, France, Spain and Portugal.[9] Abraham Rees' *Universal Dictionary of Arts, Sciences, and Literature* (1805-1825) states: *"This oil, when genuine, is brought from Provence, and some other parts of France, and is there made of Lavender"* and *"(...) a plant which grows plenty in Languedoc, in Provence, and especially on the mountain of St Baume, in France."*[10] Therefore, the author of the French BnF manuscript would most likely have used aspic oil produced in France. As it was not possible to procure aspic oil from France on such short notice, our group bought two bottles of aspic oil from different brands: Lefranc & Bourgeois and Kremer [Fig. 1: different brands of aspic oil].

The French treatise writer, painter and chemist J.F.L. Mérimée mentions aspic oil in the following (1839): *"(...) with a little of the volatile oil of lavender, the purest I could obtain (...)"*. [11] Mérimée gives a clue by stating he wanted the 'purest' oil of lavender he could obtain. This

[5] BnF. Ms. Fr. 640: fol. 56.
[6] Mills, John S., and Raymond White. *The organic chemistry of museum objects*. (Oxford: Butterworth-Heinemann, 1994), 85.
[7] A solvent: any of the volatile fluid organic compounds, which without chemical change, can convert a solid or semi-solid organic material into a technically useful solution. Gettens, *Painting materials: a short encyclopaedia*. (New York: Dover Publications, 1966), 200.
[8] Hence the term 'spike lavender oil'.
[9] Salido, S., Altarejos, J., Nogueras, M., Sánchez, A., and Pascual Luque. "Chemical Composition and Seasonal Variations of Spike Lavender Oil from Southern Spain." *Journal of Essential Oil Research,* 16:3, (2004): 206.
[10] Rees, Abraham. *The Cyclopædia; or, Universal Dictionary of Arts, Sciences, and Literature 1st American ed.* (Philadelphia: Samuel F., Bradford, and Murray, Fairman and Co, 1805-1825), 107. *"The botanists call it male lavender, lavendula mas, Spica nardi, pseudo nardus, &c."* Even though Rees' Cyclopedia was published in the early 19th century, it shows relevance to the BnF Ms. Fr. 640 manuscript as it provides information about aspic oil.
[11] Mérimée, J. F. L, and William B. Sarsfield Taylor. *The art of painting in oil and in fresco: being a history of the various processes and materials employed, from its discovery, by Hubert and John Van Eyck, to the present time.* (London: Whittaker & Co, 1839), 83. Mérimée seems to use the terms 'lavender oil' and 'aspic oil' in the same interchangeable manner as the author of BnF.

information is critical, as 'the quality of aspic oil' is mentioned in the BnF Ms. Fr. 640 manuscript. Fol. 71 states: *"Heed well that the aspic oil is quite clear and not at all fatty, otherwise your varnish will not be worth anything. You can test it by soaking some paper in it and heating it. If the oil, which will evaporate, leaves the paper clean, without a yellow mark, it is good, if not, it is fatty."* Besides this statement, fol. 67 offers the following: *"All oils, which are absorbed in paper and when warmed evaporate in the fire and leave a clear paper just like turpentine and aspic oil, are good for varnishing."*

These tests may not only implicate the presence of aspic oils of a lesser quality, but may further suggest that adulterated versions were also manufactured.[12] Rees' *Universal Dictionary of Arts, Sciences, and Literature* describes methods to produce adulterated versions such as these, and further mentions tests to discover these versions.[13] In order to determine which brand may have been most similar to the one the author of the manuscript used, this study reconstructed the quality test mentioned in fol. 71 and fol. 67.

Reconstruction: Quality test aspic oil brands: Lefranc & Bourgeois and Kremer[14]

Safety precautions were taken to reconstruct the quality test that the author mentions in two recipes [fol. 67 and fol. 71].[15] First, we had to find pieces of paper to test the two brands of aspic oil, preferably from the sixteenth-century. With the assistance of paper conservator Dionysia Christoforou, we acquired sixteenth-century pieces of paper from the Rijksmuseum department of paper conservation and restoration. Through the use of a pipette, the edges of the pieces of paper were either wetted with Kremer oil or Lefranc & Bourgeois oil [Fig. 2: application of aspic oil on a piece of paper]. To substitute for fire, we used a heating plate to accelerate the oil's evaporation.[16]

The oil of Kremer left a fatty tide line on the paper, whereas the oil of Lefranc & Bourgeois evaporated without leaving any stain [Fig. 3: evaluation of the aspic oil quality test].[17] After 90 minutes, however, the paper wetted with the Kremer oil was also stainless. It was noteworthy that the piece with the Kremer oil started to curl when heated, whereas the piece with

[12] Rees, *The Cyclopædia; or, Universal Dictionary of Arts, Sciences, and Literature 1st American ed*, 91.

[13] Rees states: *"The ready way of discovering the oil counterfeited with oil of turpentine, is to wet a paper in it, and set it on fire; the turpentine will here be discovered by the thick smoke it yields, it being of all the vegetable oil (...)"* and *"(...) which has been adultered with spirit of wine, will be distinguished by the same trial, by its yielding a much finer and thinner smoke and burning with a bright blue flame."* Rees, *The Cyclopædia; or, Universal Dictionary of Arts, Sciences, and Literature 1st American ed*, 91-92.

[14] See experiment #1 of the logbook for an elaborated description : Experiment 1

[15] The MSDS-sheets of both brands state that the oils are flammable and should be kept away from flames or other sources of ignition. The experiment was done in a fume hood. https://www.gerstaecker.nl/shared/pbox/repository/pboxx-pixelboxx-1757595/L&B%20Lavendel%C3%B6l%20300005,06%20Engl.pdf.pdf and, http://www.kremer-pigmente.com/media/files_public/73750_MSDS.pdf, accessed on 07-03-16

[16] The piece of paper was kept at a considerable distance from the heating plate, approximately 10 cm higher.

[17] A tide line: a dark outline defining the extent to which a liquid has spread.

Lefranc & Bourgeois oil did not curl. The aspic oil from Lefranc & Bourgeois was selected to prepare the varnish, as it evaporated more quickly and left no stain. Furthermore, afterwards we discovered that the Kremer oil was 'lavender oil', and additionally, the brand also sells 'spike-lavender oil', which would have been better to use as a comparison in this test.[18]

The penetrating aspect of aspic oil

In the manuscript the author mentions 'penetration' in relation to aspic oil eight times. In three of the folios, the author establishes a specific connection between 'penetration' and aspic oil as a component of a varnish. The chemistry behind aspic oil may augment the investigation as to how the oil's penetration manifests.

In *The Organic Chemistry of Museum Objects* (1994), Mills and White state that aspic oil is a complex mixture of monoterpenoids, both hydrocarbon and oxygenated, as well as some sesquiterpenoids.[19] The presence of oxygenated monoterpenoids in aspic oil indicates that it is much less volatile than oil of turpentine. The less volatile that a fluid is, then the more time it requires to penetrate the surface to which it is applied. Hydrocarbons in aspic oil act as important solvents for natural resins in the preparation of varnishes. Their ability to dissolve these resins, as well as to keep them in solution once dissolved, is dependent upon the aromatics content.[20] The MSDS-sheet of the aspic oil from Lefranc & Bourgeois states the following ingredient composition: 5-10% (R)-P-Mentha-1,8-Diene, 1-5% (S)-P-Mentha-1,8-Diene, 30-60% Linalool and 5-10% Pinenes (alpha or beta).[21] The aromatic terpenoid linalool is the major component of the aspic oil from Lefranc & Bourgeois, which affirms the oil's ability to dissolve natural resins.

K.R. Sutherland of *Van 't Hof Institute for Molecular Sciences* (2001) mentions that the penetration rate of solvents may be based on measurements of viscosity and surface tension.[22] Aspic oil has a very low viscosity, and by extension, it has a low resistance to flow.[23] The lower that a fluid's viscosity is, then the higher its rate of penetration. In addition to viscosity, surface tension also plays an important role in aspic oil's penetrating aspect. When applying a varnish, an even layer is required that fully covers the painting. In other words, the liquid must wet the surface completely. In his book *Materials for Conservation*, chemist and conservation scientist C. V. Horie states: *"To ensure good wetting behavior on organic surfaces, the surface tension of the liquid must be slightly but not much higher than that of the substrate."*[24]

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[18] The MSDS-sheets of lavender oil and spike-lavender oil from Kremer show differences in their composition.
[19] Mills & White, *The organic chemistry of museum objects*, 85.
[20] Since this is liable to vary from batch to batch, problems of insolubility sometimes arise.
[21] MSDS-sheet Lefranc & Bourgeois essence d'aspic: 2.
[22] Sutherland, K. "Solvent extractable components of oil paint films." *Studies in Conservation*, (2001): 42.
[23] Viscosity decreases as the temperature increases, as increased temperatures tend to cause increased mobility of the molecule. This relationship also explains how the heating plate, used in the quality test, accelerated the evaporation of the aspic oil.
[24] Horie, C. V. *Materials in Conservation: Organic consolidants, adhesives and coatings 2nd Ed.* (London, New York: Routledge, Taylor and Francis Group, 2010), 100.

Excerpts from the BnF manuscript as well as the reconstructions that provide visual reference material, are combined to investigate the aforementioned aspects of aspic oil. The following paragraphs investigate the penetrating aspect of aspic oil through the application of the reconstructed tempera varnish on different supports: on bare wood and on a tempera marble reconstruction with and without a glue isolation layer.

Penetration of aspic oil as a tempera varnish component on bare oak

In fol. 3, the author states the following: "*Turpentine varnish does not need any glue since it is fat and viscous and does not penetrate the wood as spike lavender and sandarac varnishes would. Spike lavender varnish does not require any glue on iron and similar materials which cannot be permeated, but on wood and on colors which do not contain gum or glue de détrempe, it is necessary to lay one coat of the said glue de retailles and allow to dry, then varnish.*" The author emphasizes that bare wood cannot be varnished with aspic oil twice, as such an application would penetrate the wood. In order to test what would occur if the tempera varnish was applied to bare wood, a reconstruction was made.

Reconstruction: Testing the tempera varnish on a bare oak support

Since fol. 56 does not mention the amounts of both aspic oil and Venice turpentine that are needed to create the varnish, multiple ratios were tested. The following respective ratios of Venice turpentine to aspic oil were made: 1:2, 1:1, 2:1 and 3:1. Besides different ratios, two different brands of Venice turpentine were tested: De Kat and Kremer. The varnish with Venice turpentine from Kremer with a ratio 2:1 was chosen as the most historically accurate option.[25] This varnish was applied to a piece of bare oak wood. Firstly, the varnish was applied in the direction of the grain, then at an angle of 90 degrees, and finally, again in the direction of the grain. The application was completed with a number 10 pure sable hair kolinsky brush [Fig. 4: application of tempera varnish on a bare oak support].[26] The wood evenly absorbed the varnish and it appeared slightly darker [Fig. 5: evaluation of the tempera varnish penetration]. This appearance illustrates that the varnish penetrated the wood and did not form an even film on top.

Penetration of aspic oil as a tempera varnish component on a tempera marble reconstruction

The tempera varnish with aspic oil is specifically meant for tempera marble that is described in the same folio [fol. 56]. The group that reconstructed the tempera marble used wood as a support, because wooden frames or furniture, among other objects, were marbled in the sixteenth-century.[27] The author of the manuscript explicitly mentions that the varnish will

[25] The reasoning behind this choice is supported in the logbook: Logbook 'Varnish for tempera' (fol.56r)
[26] Different application methods were tested. To compare the penetration of aspic oil on different supports, only the application with a brush is referred to in this annotation.
[27] Besides wood, marble imitations could also be done on plaster (on walls).

penetrate the tempera marble: *"You can make tempera marble with lacquer or rose of Ghent and chalk. Once dry, glaze it with lacquer mixed with wine, for glue will dull and blacken it. And the whole will firstly appear red, but the varnish you will apply, which will penetrate it, will make dark and light parts appear as they should."* The author's use of 'penetration' has a positive connotation in fol. 56, for it *"will make dark and light parts appear as they should".* In fol. 3, however, the author stresses: *"Turpentine varnish does not need any glue since it is fat and viscous and does not penetrate the wood as spike lavender and sandarac varnishes would."* and *"(...) but on wood and on colors which do not contain gum or glue de détrempe, it is necessary to lay one coat of the said glue de retailles and allow to dry, then varnish."* Here, the author stresses that wood and colors require a layer of glue before aspic varnish can be applied. In this context, 'penetration' is considered unwanted by the author. In order to examine the effect of tempera varnish on tempera marble, two reconstructions were implemented.

Reconstruction: Application of tempera varnish on a tempera marble reconstruction without glue sizing layer

The tempera marble reconstruction consists of four different test patches [Fig. 6: tempera marble reconstruction, four different patches]. The patches are made up of different components: glue and cochineal, glue and lac dye, egg yolk and cochineal, and egg yolk and lac dye.[28] Tempera varnish with a ratio 2:1 was applied to each test patch.[29] The varnish penetrated the patches that use glue as a medium, which resulted in the very dark appearance of the tempera [Fig. 7: evaluation of the application on the tempera marble, wet]. The patches with egg yolk as a binder reacted differently. For a short time, the varnish formed a glossy layer on the surfaces and saturated the colors of the tempera. However, the varnish slowly became invisible [Fig. 8: evaluation of the application on the tempera marble, when dried]. Although the varnish penetrated patches that used glue as a binder, the varnish is still visible as dark fragments, which is in contrast to the egg-bound tempera. The varnish on the glue-bound patches is almost black and it seems to be unlikely that the author aspired this result. Fol. 3 indicates that these patches with egg-bound paint need a layer of glue to prevent the penetration.

Reconstruction: Application of tempera varnish on a tempera marble reconstruction with glue isolation layer

The tempera marble group applied a small strip of isolation layer (made with animal glue with a glue to water ratio of 7:100) on the two egg-bound tempera marble patches. This process was

[28] The glue and egg yolk function as medium for cochineal and lac dye.

[29] The varnish with Venice turpentine from De Kat as well as the varnish with Venice turpentine from Kremer were applied. This was done to compare the differences between those brands. It is relevant for his annotation to only focus on the varnish with the Kremer component, as this varnish was defined as the most historically correct version.

undertaken to investigate whether fol. 3 of the manuscript applies for cases that prevent penetration.[30] The glue does not form an even layer, as it has poor wettability.[31] When the varnish is applied on the top, it spreads in the same manner as the glue. The varnish does not penetrate the areas where glue is adhered to the surface. The varnish does penetrate the spots where the glue is not visible. Apart from the undesirably poor wettability of the glue layer, the areas where glue adheres to the surface serve to prevent the varnish from penetrating the tempera marble. Thus, the glue isolation layer prevents the penetration of the aspic oil varnish.

Conclusion

The role of the penetrating aspect of aspic oil as a varnish component within the manuscript BnF Ms. Fr. 640 was investigated in this annotation. Together with Venice turpentine, aspic oil forms the tempera varnish of the reconstructed folio. In order to achieve the most historically accurate tempera varnish, it was important to define the best quality aspic oil, which resulted in the brand Lefranc & Bourgeois. Besides this aspect, different brands of Venice turpentine were contemplated, and ultimately, Kremer was chosen as the best option. After multiple experiments and reconstructions were completed as a group, this study defined the best ratio of Venice turpentine to aspic oil. The 2:1 mixture became a clear and liquid varnish that could be applied with a brush.

The BnF manuscript consists of many unique recipes, and their reconstruction can provide relevant information for the field of Conservation and Restoration of Cultural Heritage. The physical and optical properties of the penetrating aspect of aspic oil become tangible due to the reconstruction of these recipes. The BnF manuscript, as an art technological source, in conjunction with additional sources and critical literature, contributed to the understanding of the penetrating aspect of aspic oil. The author uses the term 'penetration' with both a positive and negative connotation. The reconstructions on bare oak wood and on tempera marble without a glue component match the description provided by the author in the recipes. Without the glue isolation layer, the bare wood and the egg-bound tempera marble are easily penetrated by the tempera varnish. The glue isolation layer prevented the penetration of the varnish, although its poor wettability did not provide the desired and expected result, which is likely a result of the surface tension of the glue. The application of the tempera varnish on the glue-bound tempera marble should have shown, according to the author, that the penetration of the varnish would saturate the colors as they should. The result, however, is a very dark and almost black tempera

[30] The patches with glue medium were not covered with a strip of glue isolation layer, because fol. 3 states that a layer of glue only is necessary for wood and colors that do not already contain glue.
[31] Wettability: The ability of a solid surface to reduce the surface tension of a liquid in contact wit hit such that it spreads over the surface and wets it.

marble. Further research should investigate what the desired result of a varnished tempera marble in the sixteenth-century would be.

As a future conservator of paintings, the use of art technological sources such as BnF Ms. Fr. 640 is very important. The research of the art historical context of materials and techniques, as well as material culture of the past, helps conservators to understand what was used by whom, where, when and why.

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MSDS-sheet lavender oil Kremer:

http://www.kremer-pigmente.com/media/files_public/73750_MSDS.pdf (retrieved March 7, 2016).

Illustrations

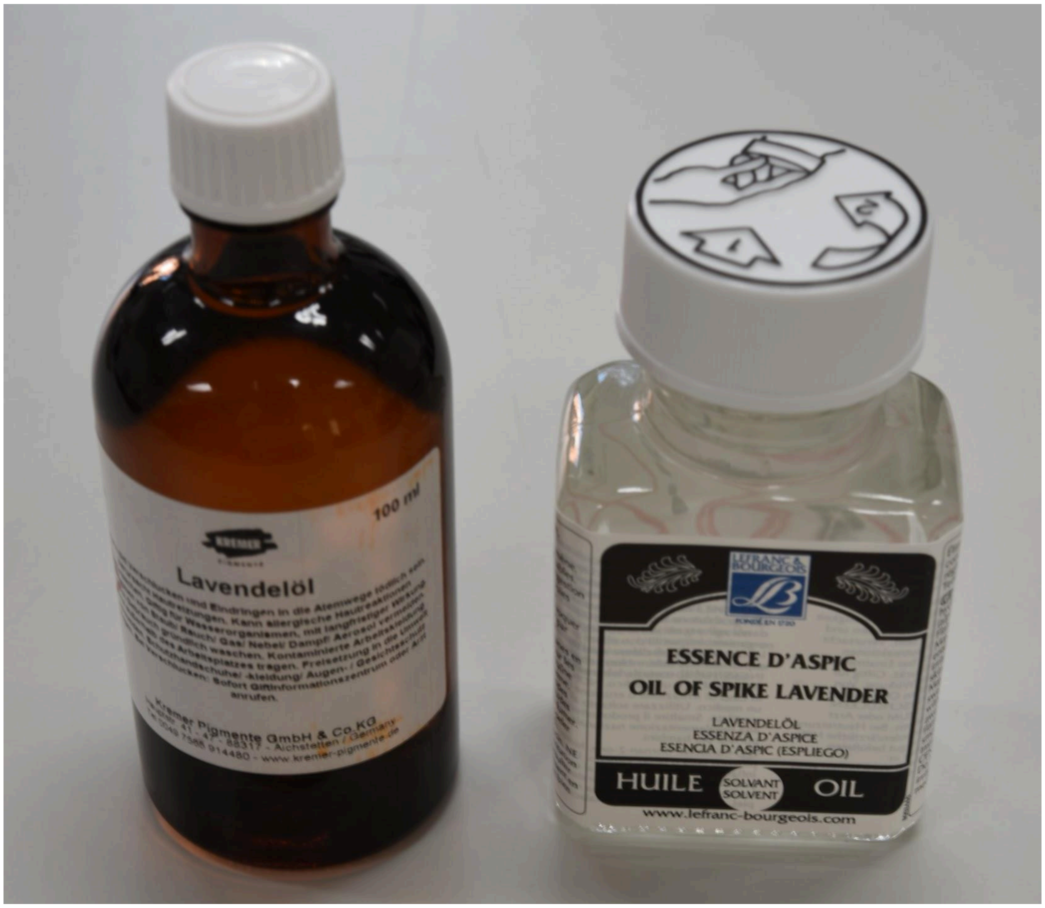


Fig. 1. 'Different brands of aspic oil', made by Sepha Wouda. From left to right: lavender oil from Kremer and aspic oil from Lefranc & Bourgeois.

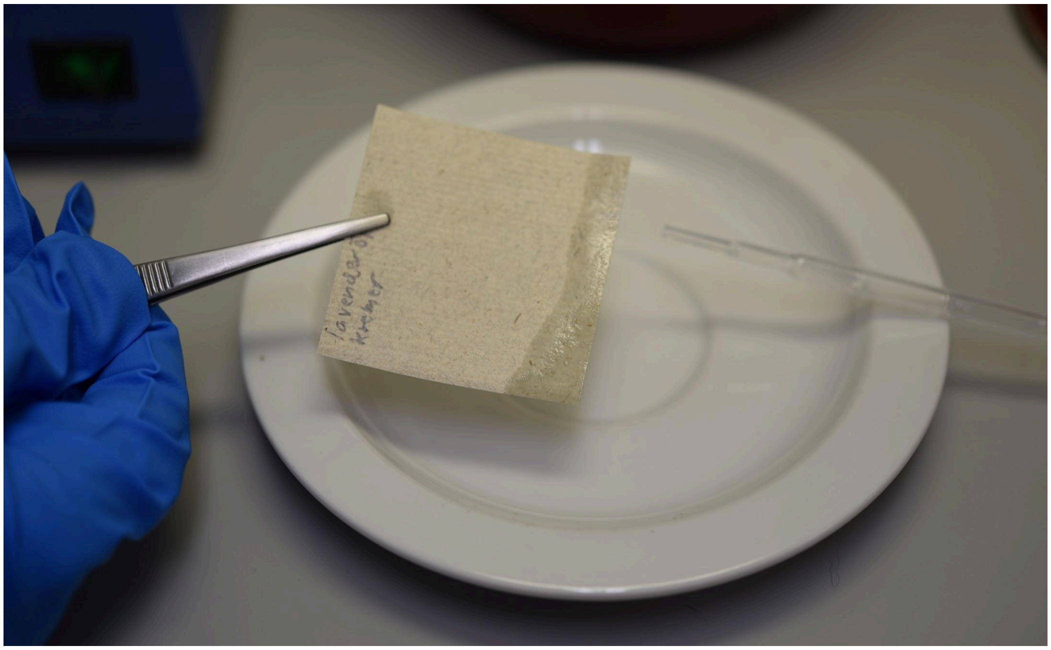


Fig. 2. ‘Application of aspic oil on a piece of paper’, made by Sepha Wouda. Application of aspic oil on a piece of paper from the sixteenth-century to test it’s quality.

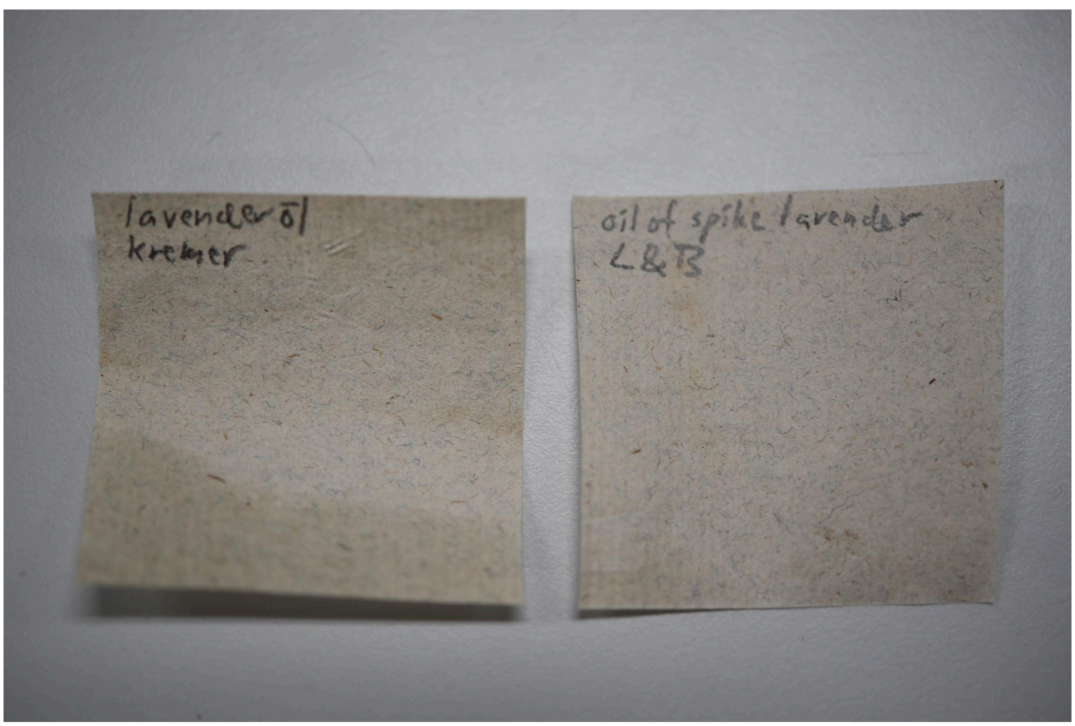


Fig. 3. ‘Evaluation of the aspic oil quality test’, made by Sepha Wouda. Left to right: the lavender oil from Kremer shows a stain at the bottom of the slightly curled paper. The aspic oil on the right paper has completely evaporated and did not leave a stain.

Fig. 4. ‘Application of tempera varnish on a bare oak support’, made by Sepha Wouda. Application of the tempera varnish with ratio 2:1 on a bare oak support.

Fig. 5. ‘Evaluation of the tempera varnish penetration’, made by Sepha Wouda. The varnish has penetrated the bare oak support. The wood got slighlty darker.

Fig. 6. ‘Tempera marble reconstruction, four different patches’, made by Sepha Wouda. Tempera marble reconstruction before varnish application. Top left: glue and cochineal. Top right: glue and lac dye. Bottom left: egg yolk and cochineal. Bottom right: egg yolk and lac dye.

Fig. 7. ‘Evaluation of the application on the tempera marble, wet’ made by Sepha Wouda. tempera marble reconstruction after varnish application. The varnish is still wet. Top patches: the lower stripe is varnish that is referred to in the annotation. Bottom patches: only the glue isolation layer and varnish on top is still visible.

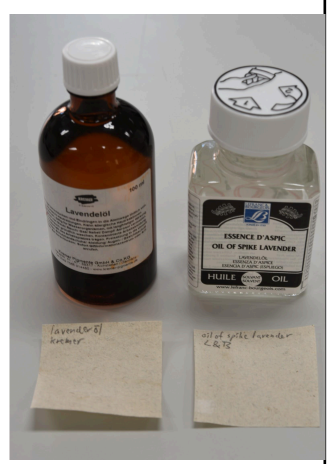
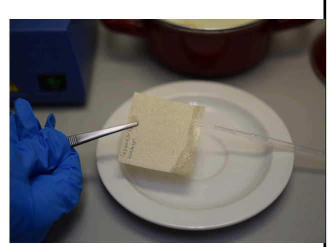
Fig. 8. ‘Evaluation of the application on the tempera marble, when dried’, made by Sepha Wouda. Tempera marble reconstruction after varnish application. The varnish has dried. The top patches do not show a significant change. The bottom patches show that the glue isolation layers became less even.

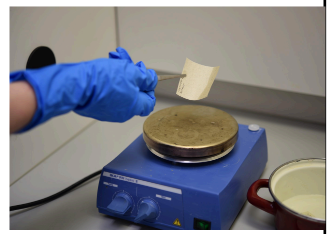
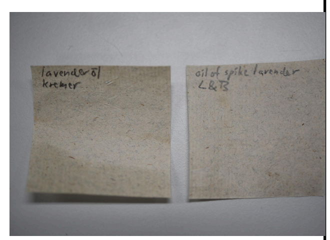
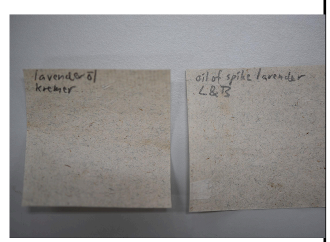
Appendix

Experiment #1: Quality test lavender oil of two brands: Kremer and Lefranc & Bourgeois

Reasoning: In the manuscript (p071v_1) a test is mentioned to define the quality of aspic oil: *“Heed well that the aspic oil is quite clear and not at all fatty, otherwise your varnish will not be worth anything. You can test it by soaking some paper in it and heating it. If the oil, which will evaporate, leaves the paper clean, without a yellow mark, it is good, if not, it is fatty.”*

Similiar to the above:
(p067r_1)
“All oils, which are absorbed in paper and when warmed evaporate in the fire and leave a clear paper just like turpentine and Here are good for varnishing.”

Date & time	Action	Observation	Photo	
17-02 9:00	A setup was built for experiment in the fume hood with a hot plate.			1
11:00	Two pieces were cut out of 16th century paper. The paper was acquired from the Rijksmuseum paper conservation-restoration department.	Both drops had the same consistency and were colourless.		2
11:20	The edge of the first piece of paper was wetted with Kremer oil using a pipette.			3

11:23	The piece of paper was heated above the hot plate (heated at level nr. 5) until it evaporated.	The paper curled above the hot plate.		4
11:26	Evaporation time was ~ 5:30 minutes.			
11:30	The edge of the second paper-piece was wetted with L&B oil using a pipette.			
11:33	The piece of paper was heated by keeping it above the hot plate (heated at level number 5) until it evaporated.	L&B evaporated faster. The paper did not curl when it was heated above the plate.		
11:38	Evaporation time was ~ 4:00 minutes	The oil of Kremer left a fat tide line on the paper. The L&B oil evaporated without leaving any stain.		5
13:00	After 1:30 hours both pieces of paper showed the same result, the lavender oil of Kremer had also evaporated.			6
	Conclusion: Kremer oil evaporated much slower. Neither oil left stains. We will use the L&B lavender oil.			
Comments: The recipe (p071v_1) that describes how to test the quality of lavender oil says that the lavender oil should evaporate without leaving yellow or fatty stains. The Kremer lavender oil initially left a darker stain that seemed to be fatty but not yellow. After drying, no tide line was left on the paper. The L&B lavender oil evaporated fast without leaving any stain. **Conclusion:** The lavender oil of L&B was chosen for preparing the varnish, as it dried quicker and left no stain, just as the author-practitioner described in the manuscript.				