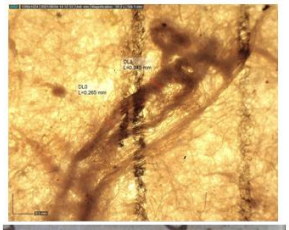

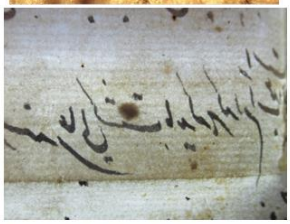

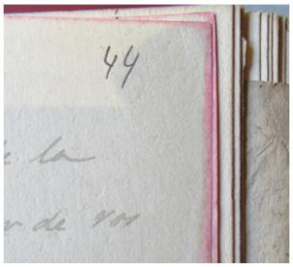

PROTOCOL FOR THE CHARACTERISATION OF NON-WATERMARKED HANDMADE PAPER

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metamorfoze KB Koninklijke Bibliotheek Nationale bibliotheek van Nederland

INTRODUCTION

The present protocol is mainly adapted to non-watermarked handmade paper, regardless of the geographical region in which it was produced.[1] It consists of a macroscopic analysis including documentation and registration of the paper characteristics, its morphology, surface, colour, fibre distribution, quality and impression of the screen among other fields. it is interesting to combine, if possible, macroscopic examination with microscopic analysis, as the latter can help to resolve questions raised by the former. Microscopic analysis with polarising microscope provides information on pulp and fibre characteristics, identification of plant species, presence of additives, etc. However, this document does not cover the methodology necessary to identify plant species. Although fibres have been identified as part of this project, the method of fibre identification is an area in its own right that has not been addressed as part of this project.[2] In addition, the data collected, combined with information on the paper technology used in a specific context and culture, will provide a better understanding of the characterisation of the finished product. Information can be obtained from historical treatises, travel accounts, technical and trade reports, colonial and international exhibition catalogues,literaturee, anthropological field-works, contemporary academic works, etc.

Today various analytical and non-destructive methods are used to analyse and characterise historical papers. For example, SEM–EDS and XRF were applied for the identification of inorganic elements. FTIR analyses were used to identify the chemical structures of the paper components. SEM–EDS, XFR and FTIR analysis also detect fillers, additives and sizing materials. However, not all professionals have access to these expensive devices, and although they provide a great deal of interesting information, they are no substitute for visual observation at both macroscopic and microscopic levels.

The document is articulated in two parts:

1. MACROSCOPIC EXAMINATION

1.1. The survey form. It is organised into fields, sub-fields and descriptions and covers general description, surface, pulp distribution, mould impressions and measurements.

1.2. Guidelines for using the form: further details are provided to explain certain fields in the form.

2. MICROSCOPIC ANALYSIS

2.1 The survey form. It is organised into fields, sub-fields and descriptions

2.2. Guidelines for the preparation of longitudinal fibre samples with permanent mounting (for long-term storage), including the step-by-step process and materials required.

1 The present protocol has been developed to examine and analyse the paper used for a collection of drawings from northwest India (known as Pahari) now preserved in the Museum Volkenkunde in Leiden (NL). The paper used was locally handmade using traditional techniques inherited from the Arabs who set up paper mills in Central Asia after the Battle of Talas in 751 AD. In this sense, the paper is not watermarked, although the traces left by the paper mould are visible on the paper sheet. The results of the project have enabled us to characterise this particular paper, which was produced in Sialkot, Pakistan and traded throughout northwest India. For a comprehensive study , see A. Couvrat Desvergnes 2023.

2 For the project, the polarizing microscope ZEISS Axiolab A1 and Olympus B×51 were used.

1. MACROSCOPIC EXAMINATION

1.1. THE SURVEY FORM

The protocol was developed in the form of an Excel spreadsheet with drop-down menus, which remains the most practical format for filling in the information and compiling statistics from the data collected. The development of this form was inspired by other protocols developed by conservators and scientists, to which specific criteria were added or removed according to their relevance, feasibility and usefulness.[3] The present form can be customised according to the requirements of the project and the type of paper being studied. Before starting the survey, it is advisable to have an initial overview in order to define the required fields. During the course of the project, with closer examination, it is likely that new fields will appear, which can still be added after the form has been drawn up.

	Field	Sub-field	Description
MACROSCOPIC EXAMINATION	**1. GENERAL DESCRIPTION**	**1.1 Title (given by the institution)**	
		1.2 Item acquisition number	
		1.3 Localisation (if known or geographical area)	
		1.4 Dimensions	**1.4.1** Height **1.4.12** width
		1.5 End use of the paper	**1.5.1** drawing or painting paper **1.5.2** poor quality, refuse **1.5.3** printing paper **1.5.4** writing paper **1.5.5** blank leaf **1.5.6** manuscript folio **1.5.7** decorated paper **1.5.8** other
		1.6 Type of paper	**1.6.1** Laid western **1.6.2** Laid eastern **1.6.3** Laid middle-eastern **1.6.4** other
		1.7 Colour	**1.7.1** Natural **1.7.2** Coloured
		1.8 State of the sheet	**1.8.1** fragment **1.8.2** trimmed **1.8.3** untrimmed
		1.9 Sound	**1.9.1** Crispy **1.9.2** Rustling **1.9.3** Dull **1.9.4** no sound
		1.10 Flexibility/resistance	**1.10.1** weak **1.10.2** soft

[3] Anna-Grette Rischel, Khartasia Kagi, Bas van Velzen, Geneviève Humbert, IPH International standard for the registration of papers with or without watermarks http://www.paperhistory.org/standard.htm

			1.10.3 stiff **1.10.4** pliable
		1.11 Manufacture defects	**1.11.1** papermaker's tear **1.11.2** wrinkles **1.11.3** thinning **1.11.4** fragment of paper from another sheet **1.11.5** splitting **1.11.6** hole **1.11.7** manufacturing tear
		1.12 Condition	**1.12.1** very good **1.12.2** good **1.12.3** fair **1.12.4** poor **1.12.5** very poor

	Field	Sub-field	Description
MACROSCOPIC EXAMINATION	**2. SURFACE DESCRIPTION** With natural and raking light and with magnification.	**2.1 Surface appearance of the recto**	**2.1.1** Mat **2.1.2** Rough **2.1.3** Irregular **2.1.4** Smooth **2.1.5** Glossy
		2.2 Surface appearance of the verso	**2.2.1** Mat **2.2.2** Rough **2.2.3** Irregular **2.2.4** Smooth **2.2.5** Glossy
		2.3 Surface treatment	**2.3.1** No surface treatment **2.3.2** application of colour **2.3.3** coating **2.3.4** primer **2.3.5** calendered **2.3.6** marks of hammer or other pounding tool **2.3.7** marks of smoothing tool
		2.4 Condition of surface treatment recto	**2.4.1** even **2.4.2** non-even
		2.5 Tool recto	**2.5.1** use of a large tool **2.5.2** use of a medium tool **2.5.3** use of a narrow tool **2.5.4** no visible marks
		2.6 Condition of surface treatment verso	**2.6.1** even **2.6.2** non-even none
		2.7 Tool verso	**2.7.1** use of a large tool **2.7.2** use of a medium tool **2.7.3** use of a narrow tool **2.7.4** no visible marks
		2.8 Drying method	**2.8.1** traces of a brush **2.8.2** traces of the wall

			2.8.3 traces left by a felt **2.8.4** traces left by a cloth

	Field	Sub-field	Description
MACROSCOPIC EXAMINATION	**3. PULP DESCRIPTION** On the lightbox	**3.1 Pulp repartition**	**3.1.1** even/clear **3.1.2** moderately even **3.1.3** uneven/cloudy **3.1.4** Very cloudy
		3.2 Fibre direction	**3.2.1** dominant **3.2.2** random
		3.3 Fibres appearance	**3.3.1** presence of long fibres **3.3.2** presence of medium fibres **3.3.3** presence of short fibres **3.3.4** mixture of short, long, and medium fibres
		3.4 Fibres arrangement	**3.4.1** Stand-alone fibres **3.4.2** bundles of unprocessed fibres **3.4.5** clumps
		3.5 Internal elements	**3.5.1** uncoloured yarn **3.5.2** coloured yarn **3.5.3** fragment of retree (repulped paper cuttings) **3.5.4** mall fibres of different colours **3.5.5** bark or shive
		3.6 Other significant features	**3.6.1** Black particles **3.6.2** Micro-holes **3.6.3** Unknown substance

	Field	Sub-field	Description
MACROSCOPIC EXAMINATION	**4. MOULD IMPRINTS** On the lightbox	**4.1 Type of screen**	**4.1.1** wire laid lines **4.1.2** bamboo **4.1.3** reeds **4.1.4** cloth **4.1.5** presence of rib shadows **4.1.6** not identified **4.1.7** other
		4.2 Deckle edge	**4.2.1** presence of a deckle edge **4.2.2** presence of two deckle edges.
		4.3 Laid lines visibility	**4.3.1** clearly visible laid lines **4.3.2** partially visible laid lines **4.3.3** no visible laid lines
		4.4 Laid lines repartition	**4.4.1** even **4.4.2** Random
		4.5 Laid lines feature 1	**4.5.1** thin **4.5.2** medium **4.5.3** thick
		4.6 Laid lines feature 2	**4.6.1** Straight **4.6.1** undulated
		4.7 Chain lines visibility	**4.7.1** clearly visible chain lines

			4.7.2 partially visible chain lines **4.7.3** no visible chain lines
		4.8 Chain lines feature 1	**4.8.1** thin **4.8.2** medium **4.8.3** thick
		4.9 chain lines feature 2	**4.9.1** straight **4.9.2** undulated
		4.10 Chain lines arrangement	**4.10.1 r**egular **4.10.2** grouped by 2 **4.10.3** grouped by 3 **4.10.4** random **4.10.5** other types of arrangement

	Field	Sub-field	Description
MACROSCOPIC EXAMINATION	**5. MEASUREMENTS** With tools described in the next section	**5.1 Thickness**	**5.1.1** measurement 1 **5.1.2** measurement 2 **5.1.3** measurement 3 **5.1.4** measurement 4 **5.1.5** average thickness
		5.2 Colour	(See next section)
		5.3 Glossiness	**5.3.1** measurement 1 **5.3.2** measurement 2 **5.3.3** measurement 3 **5.3.4** measurement 4 **5.3.5** average glossiness
		5.4 Laid lines number	**5.4.1** number of laid lines/1cm **5.4.2** number of laid lines/2cm **5.4.3** number of laid lines comprised in 20 or 30 mm **5.4.4** Average number of laid lines
		5.5 Chain lines number	**5.5.1** distance between two chain lines-1 **5.5.2** distance between two chain lines-2 **5.5.3** distance between two chain lines-3 **5.5.4 a**verage distance between chain lines
		5.6 Number of visible chain lines	[free text]

2. Surface description

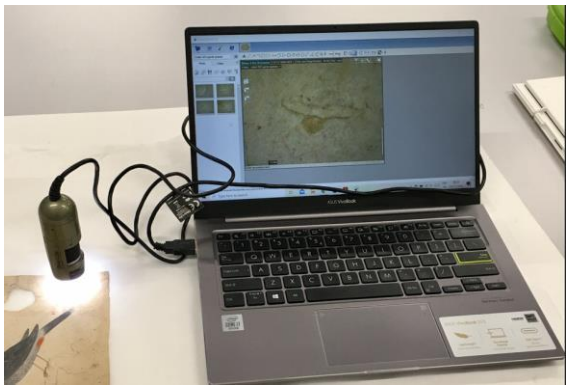
Besides the use of natural, raking, and UV light, the observation of the surface can be done with the help of two methods:[4]

- **Thread Counter**

An easy-to-use and cheap tool for primary examination.
It is available in all of the conservation suppliers

- **Dinolite®**

Many models are suitable for paper examination.



2.3 Surface treatment

This field is relevant for papers that have undergone a specific surface treatment. This is the case for Islamic papers, which are generally burnished. Far Eastern papers show a smooth and a rough side resulting from the drying process on hot walls.

3.1 Pulp repartition

This field can tell us a lot about fibre preparation and sheet formation, as well as the skill of the papermaker. Fibre distribution is linked to technological processes in pulp preparation. It also tells us about the quality of the paper and the degree of fibre blending. Uneven fibre distribution in the finished paper is often due to inadequate fibre preparation during the pulping process, but also to the papermaker's ability to distribute the pulp evenly in the mould.[5] The shallow or partial beating of the fibres will interfere with the distribution of the pulp in the finished sheet. The distribution of the pulp is also linked to the size of the sheet: the larger the sheet, the more difficult it is to distribute the

[4] For the project, the portable UV light flashlight Gatzetec WF-501B
https://www.gatzetec.de/Taschenlampen/Gatzetec/UltraFire-WF-501B-CREE-XPL-HI-V3.html
[5] Helman-Wazny A., 2016.

fibres evenly. This is why the process has been made easier by adding plant extracts or starch solutions to the pulp to help distribute the fibres evenly and prevent flocculation.
The assessment of pulp repartition in a sheet of paper is carried out in transmitted light using a lightbox.

For flat paper works: dimmable LED lightbox[6]

For books: LED light sheet[7], light-weight, ultra-thin (0,5 mm) and flexible.

3.2 Fibre appearance

The presence of fibres of varying lengths indicates the processing method. The presence of long and good-quality fibres may indicate that the paper was produced from native fibres and could have been beaten by hand. Short and fibrillated fibres may suggest that these were recycled or processed with mechanical technology. The presence of bundles of unprocessed fibres indicates that recycled woven or twisted materials were used to produce pulp such as cloth, rags canvas, cordage, sacking, matting etc… [8]

3.3 Internal elements

The presence of various elements that make the paper unclear and irregular is the result of the degree of cleaning of the materials, retting, cooking, beating and washing of the pulp. The presence of small pieces of bark may be the result of careless or partial manual removal as well as a quick retting process. Clumpings are generally loose fibres that have clumped together due to the action of the hammers. Fragments of yarn, coloured or not, suggest that woven products have been recycled in the pulp. Small pieces of recycled retree paper have a distinct, palpable, shape that

[6] For the project, I used the Daylight Wafer 2 https://www.vanbeekdesign.nl/p/daylight-wafer-2-lightbox-a3/88312/?gclid=CjwKCAjwp6CkBhB_EiwAlQVyxYDFgM0XBamjQEHf4BRC28i7Hv8MYXTcKk9GiL1h4McDTTnwfwd57xoCsAsQAvD_BwE
[7] https://www.cxdinternational.com/furniture/lighting-equipment/cxd-light-sheet-a4-eu-eqflse0004
[8] Couvrat Desvergnes A. 2023.

protrudes from the surface of the paper, indicating that the paper cuttings have been reused in the pulp.[9]

- **However, these are just a few examples of how the presence or absence of these elements should be interpreted. Their observation, combined with information on the paper technology used in a specific context and culture, will help to better understand the characterisation of the finished product.**

5.1 Thickness

Thickness information is used to determine two main skills: the papermaker's ability to produce sheets of variable thickness and his ability to obtain sheets of regular thickness. The measurements are taken on the four edges with a micrometre. An average of the 4 measurements will be calculated in an additional column with the average formula.

A digital micrometre is easier and more straightforward to use than a manual gauge.

5.2 Colour

The measurement of paper colour is an aspect that is generally not taken into account in paper surveys. The investigators maintain that it is irrelevant because the initial colour of the paper is gradually altered over time. Factors that induce colour alterations are numerous: inherent factors responsible for the natural ageing of the paper or its components (acid hydrolysis) and external factors (pollutants, light, temperature, humidity and fluctuations, etc). While this argument may be valid for archaeological papers or papers from caches such as guenizas that have been damaged by dust or soiling from burial, or for modern wood pulp-based papers that discolour over time, the colour remains nonetheless a relevant criterion that can provide a great deal of information about quality and manufacturing methods, materials used, etc. This is particularly prevalent for papers that were safely kept or for paper folia that are bound inside bindings away from light and other external degradation factors.

Colour is often the result of a specific papermaking technique and depends on the raw materials and their treatment, such as washing, cooking, bleaching and pulping. Colour is often seen as a sign of quality and grading: the whiter the paper, the more expensive and valued it is. However, this feature only makes sense within a group that allows us to compare items of the same construction and composition.[10] This is why it is important to examine other materials outside the initial corpus in order to obtain a global view of paper produced in the same cultural context and used for other types of objects.

[9] Velzen 2018, p. 19.
[10] Arnaud-Nguyen 2019.

Colour measurement

The most scientific and precise way is to measure the colour with a **spectrophotometer** which provides **CIE L*a*b*** coordinates which are the norms defined by the International Commission on Illumination. However, if you don't have the budget, the **Munsell colour chart** is a good alternative based on the Munsell classification system. It requires no technology and can be carried out in situ, although measurements must be taken in good natural light to avoid distorting the reading.

- **Subjective visual assessment:** some interviewers indicated that they used their own method by simply characterising the colour of the paper by several different shades (around 5): white, off-white, cream, brown, grey, etc. However, this method remains fairly subjective and depends on the interviewer's own visualisation of the colours and on the ambient light.

- **Portable spectrophotometer Konica Minolta**

(Minolta CM 700 d and CM-600d have been successfully used in conservation and research project)[11].
It provides CIE L***a***b*** coordinates

- **Munsell Soil Colour Charts[12]**

The charts are used in geology, archaeology and forensics to identify the colours of soils. The theory is based on Munsell's classification System. It is an easy, straightforward way to measure colour.

[11] https://www5.konicaminolta.eu/fr/instruments-de-mesure/produits/couleur/spectrophotometres-portables/cm-700d-cm-600d/introduction.html
[12] https://munsell.com/color-products/color-communications-products/environmental-color-communication/munsell-soil-color-charts/

5.2 Glossiness

This field is relevant for papers that have received a specific surface treatment such as burnishing, calendering, etc. An average of the 4 measurements will be calculated in an additional column with the average formula. The glossiness is measured with a glossmeter.

Gloss measurement

The glossmeter used for the project was purchased from PaintGauges.co.uk (reference GM2) . [13] It is a digital glossmeter that optically measures surface reflectivity at multiple angles (20°, 60°, 85°) and can be used to calculate haze.

Its multi-angle measuring capability means it is suitable for measuring the widest variety of surfaces and gloss levels. Its 20° angle is ideal for very high gloss surfaces such as polished metals and its 85° angle is ideal for very low gloss surfaces such as matt paints. This eliminates the need to own multiple meters of different specifications and its capability to take simultaneous readings at each angle speeds the measurement process. If a gloss reading is over 70GU at 60° then the reading at 20° is often selected. If a gloss reading is below 10GU at 60° then the reading at 85° is often selected.

4. Laid lines and Chain lines visibility

Their visibility in a sheet of paper depends on the construction of the papermaking screen and the thickness of the sheet of paper. Chain lines are visible depending on several factors: the material used (horsehair, wire, thread, nylon line, etc.), their condition (over time chain lines become worn and are less likely to leave marks on the sheet of paper) and the way they have been woven around the laid lines (whether they protrude enough over the surface to leave a clear impression on the paper). However, the visibility of these lines can be hampered by the surface treatment of the paper: dyeing, sizing, coating or burnishing often disrupt their observation.

5.4 Laid lines numbers 5.5 Chain lines numbers

The counting of laid and chain lines is an aspect that was initially used for Western watermarked paper. However, it is also accurate for paper with visible impressions left by the paper mould. For instance, it has been used, for example, to characterise Islamic paper. This allows comparisons to be made between different papers and also shows the degree of progress and technology involved in making the mould. Some researchers have highlighted the fact that the number of lines laid means a higher level of achievement and skill in making the mould and, by extension, in making the paper. This is why recording the width, configuration and distribution of the laid and chain lines also provides important data in understanding paper technology.

[13] https://www.paintgauges.co.uk/shop/gm2-gloss-meter/

2. MICROSCOPIC ANALYSIS

2.1 THE SURVEY FORM

Institutions and owners are often reluctant to carry out destructive analyses and therefore to take samples, although the samples are micro-scale; only a few millimetres are required. Recent research projects have demonstrated the use of non-destructive methods to identify fibres, without taking samples, using the high-magnification digital microscope directly on the paper surface.[14] Although this method has certain advantages, there are some reservations about the relevance of the results, as the fibres are interwoven in the substrate, so their characteristics are not fully visible, along with many related features such as crystals, associated cells, fillers, etc. In the author's experience and opinion, sampling and microscopy remain the most straightforward and instructive means of identifying fibres and understanding paper technology by characterizing the pulp as represented in the sample. The analysis should be made with a polarising microscope, which allows us to visualise clearly the fibre features through the polarising lens. [15] Hertzberg and Graff-C staining tests, for example, are commonly used to get a better look at fibre characteristics, but these reagents are no longer commercially available and have to be made by the end users themselves.[16] For this project, no staining tests were carried out, but the fibres were identified on the basis of their physical anatomy and with the help of two fibre atlases (Catling/Grayson; Sisko/Pfäffli). As these atlases refer to untreated textile fibres and not to reused paper fibres, reference samples were also taken from raw and processed materials to broaden the database of comparison materials.

The following table, in the form of an Excel spreadsheet, can be used as a basis for the microscopic study of paper samples. It can be adapted to the means and needs of a specific project.[17]

	Magnification	Field	Sub-field	Description
MICROSCOPY ANALYSIS	**Overall description of the fibres and the pulp at 5x**	Length of the fibres	Short Medium Long Mixture of fibres of various lengths	
		Thickness of the fibres	Thin Medium Wide Variable	
		Shape of the fibres	Straight Slender Rigid	

[14] The method was developed by Japanese scientists Osaka and Sakamoto. See also Emilie Arnaud-Nguyen, 2019. The fibres were analysed in situ by Lucas Llopis (EPHE / CRC) and Léon-Bavi Vilmont (CRC) without sampling, using a Keyence VHX 6000 digital microscope equipped with a VH-Z 1000 R objective. Transmitted and raking light was used. The paper was scanned at x100 magnification to observe the surface appearance. A magnification of between x200 and x500 was then used to observe and identify coarse elements such as threads or clusters of fibres, while a magnification of x1000 was used to identify fibres.

[15] Polarized light microscopy involved two polarizers crossed (one above the fiber specimen, the other below the fiber specimen), the image observed has a dark black background. Depending on the molecular order within the specimen, the features of the fiber are seen as brilliant colors of the spectrum (the Michel-Levy chart).

[16] The recipes to make these reagents are available on https://www.conservation-wiki.com/wiki/BPG_Spot_Tests#Lignin_and_General_Fiber_Content

[17] For more details on fibre identification and morphology see https://www.conservation-wiki.com/wiki/BPG_Fiber_Identification; https://cameo.mfa.org/wiki/Fiber_Morphology_Definitions_used_in_the_Fiber_Reference_Image_Library and both aforementioned atlases.

			Angular Flexible Convoluted Twisted Flat Flabby	
		Fibre direction	Random Dominant	
		Fibre arrangement	Stand-alone fibres Clumps of short fibres Compact bundles of fibres Unseparated fibres	
		Other substances	Unsubstantial substance Black substance Amorphous substance (cambium cells) Loose wwall cells	
	Overall description of the fibres at 10 x	Quality of the fibres	Good quality fibres with visible features Medium-quality fibres with uneven visible features Poor quality fibres with non-visible features Short and very fibrillated fibres	
		Degree of fibrillation	None Light Medium Heavy	
	Fibre identification at 20 x and 50 x	Type of fibre	[species]	
		Associated cells of the plant species:	Presence Absence	Parenchyma Vascular vessels Epidermis cells Hairs Other
		Lumen	Not apparent Wide Narrow Even Variable Constricted Interrupted	
		Cell walls	Thick Thin Varying thickness Scimitar like	
		Crossmarkings	None Few Moderate Many	

		Longitudinal markings (striations)	None Few Moderate Many	
		Dislocations in the fibre	None Few Moderate Many	
		Bulging	None Few Moderate Many	
		Bursting	None Few Moderate Many	
		Fibre end	Natural end	Tapering Pointed Rounded Branched
		Fibre end	Non-natural end	Cut Fibrillated frayed
	Other components at 20 x and 50 x	Additives: starch grains	None Few Moderate Many	
		Additives: dispersing agent	None Few Moderate Many	[nature]
		Additives: mineral filler particles	None Few Moderate Many	[nature]
		Calcium oxalate crystals	None Few Moderate Many	rhombic clusters clusters in chains cubic prismatic

2.2. HOW TO PREPARE LONGITUDINAL FIBRE SAMPLE WITH PERMANENT MOUNT (FOR LONG-TERM STORAGE)

2.2.1. **MATERIALS FOR SLIDE PREPARATION** (Most of the materials were purchased from Carl Roth). [18]

Slide superfrost®

Coverslips

Sample bottles for storing the samples with a permanent pen to mark the sample # on.

[18] https://www.carlroth.com/nl/nl

Microscope slide tablet to keep the slides flat and tidy while the water evaporates

Slide box to store the permanent slides.

Entomologist kit including tweezers, small scissors, and probes to separate the fibre in the paper sample.

2.2.2. MOUNTING MEDIUM

Nitrile gloves should be used when handling the following products

- Canada balsam, 25 ml [19]

  It is the oleoresin of the balsam fir tree (Abies balsamea) of boreal North America. The resin, dissolved in essential oils, is a viscous, sticky, colourless or yellowish liquid that turns to a transparent yellowish mass when the essential oils have been allowed to evaporate. Due to its high optical quality and the similarity of its refractive index to that of crown glass (n = 1.55), purified and filtered Canada balsam was traditionally used in optics as an invisible-when-dry glue for glass, such as lens elements. also commonly used for making permanent microscope slides.

  The resin very viscous and therefore tedious and time consuming to use, which represents a substantial workload. What's more, it takes at least a week for it to dry, so slide preparation has to be planned well in advance, However, slides made with Canada balsam are renowned for their longevity!

  It is advisable to buy a small bottle, as the balm dries out in a few weeks in the container, which is not airtight enough. It is also very difficult to clean, even with a large quantity of ethanol.

Warning

- Euparal, 100 g. An alternative to Canada balsam[20]. It contains eucalyptol and paraldehyde. It is more fluid than Canada Balsam and therefore much easier to use.

Danger

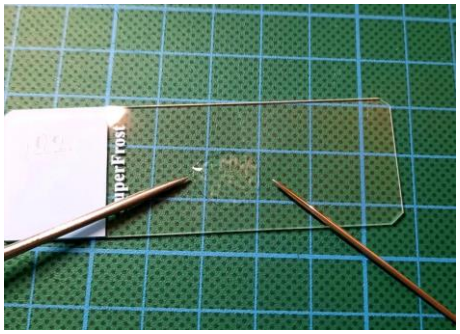
[19] https://www.carlroth.com/nl/nl/anhydrous-mounting-media/canada-balsam/p/8016.1
[20] https://www.carlroth.com/nl/nl/long-term-mounting-with-euparal/euparal/p/7356.1

- Mounting medium Eukitt® from Merck (containing 45% acrylic resin and 55% xylenes) used in microscopy. It is more fluid than Canada Balsam and dry faster (20 minutes). [21]

- For semi-permanent mount: glycerol in dionised water, 50/50.[22] The slide can be used for a set period of time and can be sealed with clear nail varnish.

2.2.3. SLIDE PREPARATION PROCEDURE

1. Take a minute sample of fibre and place it on a slide with a drop of deionised water. Label the slide. With the help of the pin and separate the fibres. The better the sample preparation, the more visible the fibre characteristics.

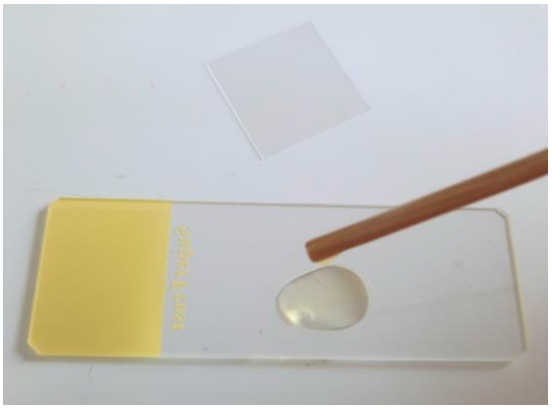


2. Place a coverslip on top once all the fibers have been well separated. Make sure no air bubbles are trapped between the slide and the coverslip. If it is, press gently with a finger to evacuate the air.

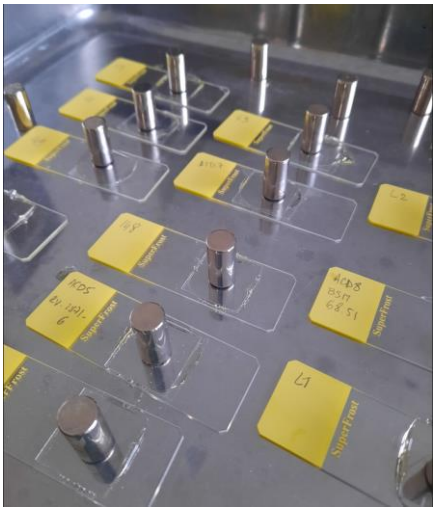
[21] https://www.sigmaaldrich.com/NL/en/product/sial/03989
[22] https://www.carlroth.com/nl/nl/water-soluble-mounting-media/protein-glycerol/p/p049.1

3. Place the slide flat in the tray and allow the water to evaporate for a day or two.

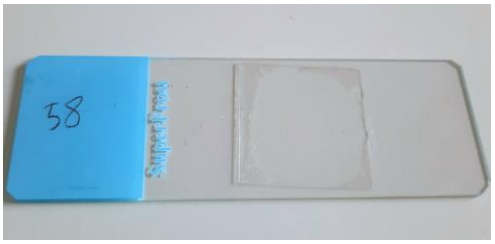
4. Open the coverslip and set aside. Place a drop of Canada balsam or other mounting product on the fibers and carefully press the coverslip back into place with your finger.



5. Place the slide on a metal surface and apply a strong neodymium magnet to the top of the coverslip. In this way, the fibres will be compressed in the same plane, making it easier to focus the microscope.



6. Clean the slide thoroughly: scrape the resin from around the coverslip with a scalpel. A little ethanol will help remove any residual mounting medium (Canada balsam).



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