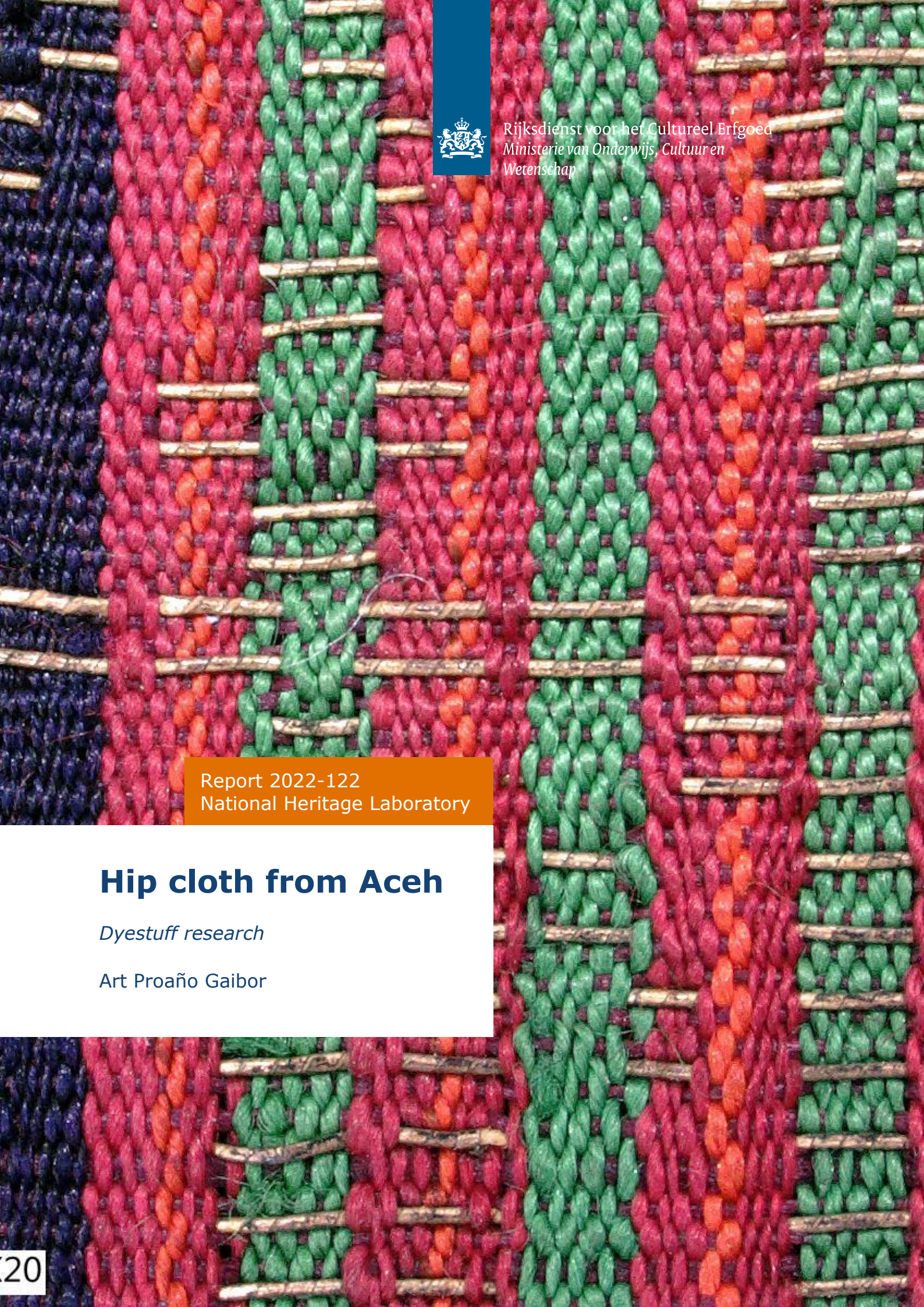

Rijksdienst voor het Cultureel Erfgoed
Ministerie van Onderwijs, Cultuur en Wetenschap

Report 2022-122
National Heritage Laboratory

Hip cloth from Aceh

Dyestuff research

Art Proaño Gaibor

X20

Colophon
Research report 2022-122
Cultural Heritage Laboratory

Hip cloth from Aceh
Dyestuff research
Date: 22-6-2023

Inventory number: RJM_16608
Author(s): Proaño Gaibor, A., Joostem, I.

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Appendix III: SEM-EDX results

Object data

Inventory no.	RJM_16608
Organisation	Rautenstrauch-Joest-Museum - Cultures of the World
Artist	Unknown
Title	Hip cloth
Date	End of 19th century
Location of creation	Aceh, Indonesia
Current location	Collection of Rautenstrauch-Joest-Museum
Dimensions	W: 720 mm H: 1,970 mm
Object Type / Materials	Silk? Gilded copper threads

Image 1. Hip cloth from Aceh

Summary

The hip cloth (Idja Pinggang) textile was acquired by Carl Holthausen in Aceh around the turn of the century and purchased by the Rautenstrauch-Joest Museum from his estate after his death in early 1906.c

It was made in the last ten years of the past century. The textile is made from two fibres. One being mercerized cotton and the other silk. It appears that alum or an alum salt was used for the mordanting of the silk fibres. And in the first sample tannins were used as a mordant for the basic dyes to attach to the cotton.
The natural sources found come from Natural brown 6 (source still unsure) and Lack dye (Natural red 25),

The synthetic dyes used in this samples are: Basic violet 1, Acid yellow 1, Acid green 5, Acid orange 17, Acid red 8 and Basic violet 14 .

The results are in accordance with J. Kreemers book from 1922. There he explains that for the cotton threads dyeing synthetic dyes replaced the use of local natural dyes. Also Veltman in his manuscript on the Aceh's silk industry from 1912, he explains that synthetic dyes made their way to local Aceh dyeing workshops.

1. Introduction

1.1 Background

The hip cloth (Idja Pinggang) textile was acquired by Carl Holthausen in Aceh around the turn of the century and purchased by the Rautenstrauch-Joest Museum from his estate after his death in early 1906.c

The female hip cloth I not short (as with the men), but always long, it is worn over the Knees, so that of the trousers only the embroidery on the lower edge of the pipes is visible. Usually one uses for this a batik or palikat-kain, sometimes also simple black goods. On festive occasions expensive old-fashioned silk cloths are often worn, such as: the dark purple idja lambajöng, the (nowadays very rare) catted idja plang rusa with white and black arrowheads, the idja Lam Goegob and the idja Lam Bho, often interwoven with gold and silver thread.

The requested dye analysis is part of an extensive investigation of the textile and is intended to provide the basis for further material technical investigations on comparable objects. In addition to researching a special weave-technical feature of the silk fabric, the metal thread has already been examined. The results are to be presented in the museum as well as published in a scientific article in cooperation with the Australian Aceh researcher Dr. Babara Leigh.

Working meeting with Dr B. Leigh (Australia), Dr F. Brinkgreven (Netherlands) and Petra Czerwinske at the Leiden Ethnological Museum. Here the results of the dye analysis could be compared with other Aceh textiles from the extensive Leiden collection

2. Methodology

The analysis of 4-5 dyes on silk, possibly including mordants, is requested. It should be examined whether the colourings correspond to the contemporary explanations by J. Kreemer (1922, pp. 541-543). Of particular interest is the dark purple colouration (lambajong),which could prove to be a typical Aceh scale insect colouration (malo) in connection with an additional treatment with black ferrous mud (leuhob)

3. Results

3.1 SEM-EDX results

Electron microscope images were taken of the sample and EDX analyses of the fibres. In table #1 an overview of the EDX result interpretation is shown. It appears that the threads are composed of a mix of silk and mercerized cotton. An aluminium salt may have been used as a mordant for the silk fibres. Also it is possible that sodium chlorite was used as an additive for the dyeing process as was a common practice in the 19th and 20th century..

Table 1.

Sample	description	What	Spectrum/Image	Elements	Discussion
2022-067#1	Dark purple thread	Fibre	001	**C, O,**(Na), (Si) S, (K)	Silk(?) and some fibres looked like mercerized cotton.
		Fibres	002		Silk(?) and mercerized cotton
2022-067#2	Red thread	Fibre	001	**C, O,**(Mg), (Na) S, (Cl)	Mercerized cotton fibres mercerized
		Fibre	002	**C, O,** (Na), S, Cl, (K)	
		Fibre	003	**C, O,** (Na),Mg, S	Silk fibre
2022-067#3	Bright green thread	Fibre	001	**C, O,** (Na),Al,(Si) S, Cl, (K)	Silk fibre
		Fibre	004 – 001 - 2		Silk and mercerized cotton fibres 8.508µm to 9.024µm
2022-067#4	Orange thread	Fibre	001	**C, O,** N,(Mg), (Na) Al, S, (Cl), (Ca)	Mercerized cotton fibers and silk

3.2 UHPLC-PDA-HRMS results

Analysis of the four samples showed that all fibres were dyed with synthetic dyes and some natural dyes. In table 2 an overview of the results is given

Table 2. results overview UHPLC-PDA-HRMS

	2022-122#1 Dark purple	**2022-122#2 Red**	**2022-122#3 Green**	**2022-122#4 Orange**
Component name				
Gallic acid	**X**			
Acid green 5			**X**	
Acid yellow 1			**X**	**X**
Laccaic acid A/D	**X**	**X**		
Erythrolaccin (Of lack dye)		**X**		
Fuchsine (Basic violet 14)	**X**			
Methyl violet component (Basic violet 1)	**X**			
Ellagic acid (Natural brown 6)	**X**			
Acid red 8	**X**	**X**		
Acid orange 7				**X**
Acid orange 17				**X**
Interpretation	*Tannin source, Lac dye, Acid red 8, Fuchsine and Methyl Violet*	*Lac dye and Acid red 8*	*Acid green 5 and Acid yellow 1*	*Acid yellow 1, Acid orange 7 and Acid orange 17*

4. Discusion

4.1 Sample 2022-122 #1

The purple sample was dyed with lack dye, due to the presence of laccaic acids. Also a blueish Methyl violet with ethylated components were found. Gallic acid and ellagic acid
And finally a small amount of acid red 8 was also found in this sample. Image 1 shows the single ion chromatogram of the components found with the mass spectrometer. The extended data is shown in Appendix II

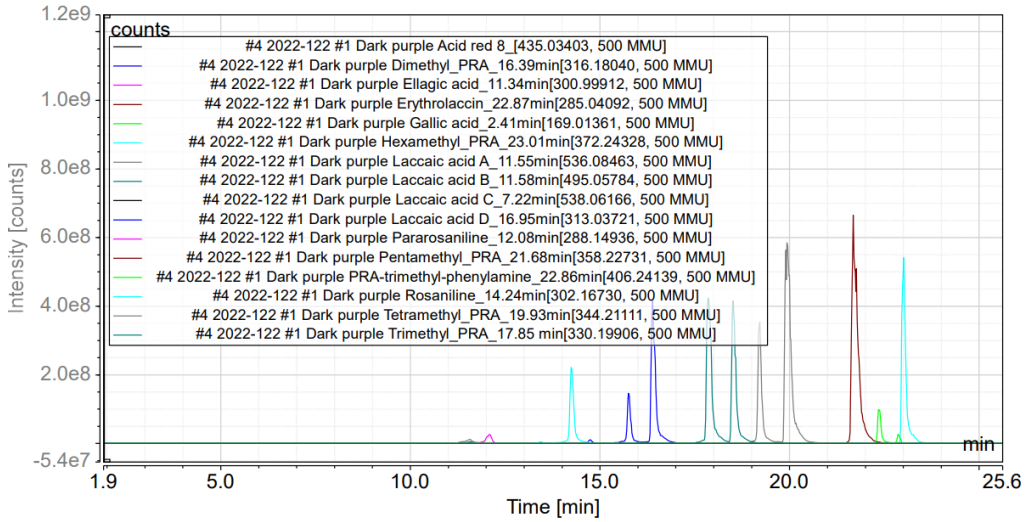


Image 1 Single ion chromatogram 2022-122#1

The tannins, ellagic acid and gallic acid may be an extract of Aleppo- or Smyrna gallnuts (*Quercus infectoria* Oliv.), Teri or Udakiryaka (pods of *Moullava digyna* (Rottler) Gagnon & G.P.Lewis), Garam (*Ceriops roxburghiana* Arn.),Tingi (*Ceriops togal* (Pers.) C.B. Rob.) Myrobalans (*Terminalia chebula* Retz.) or Chinese sumac (*Rhus javanica* L.).

Myrobalans and Teri are the source of the tannins because of the absence of chebulic acid and the absence of type C component (Teri has Type C like the Caesalpinea pods). Its colour index name is Natural Brown 6. The tannins are used most like used as mordant for the plant fibre part in order to fix the basic dye to the cotton.

Basic violet 3 and Fuchsine were found in the sample. There two synthetic dyes are the only basic dyes (positive ionized) found in the object. Basic violet 3 is a synthetic dye discovered in 1861 by Lauth. Its classical name is Methyl violet .
Fuchsine is a reddish violet synthetic dye discovered by Nathanson in 1856. Its colour index name is Basic violet 14.

The presence of laccaic acid component suggest the use of lack dye (*Laccifer lacca* Cockerell.), in Indonesia known as Malò Siëm, this species lives on various trees in insular Southeast Asia and India.
Finally a trace of Acid red 8 was found in the sample, this dye was discovered in 1886 by O. Gürke and C. Rudolph. Its classical name is Cochineal scarlet P/S.

4.2 Sample 2022-122 #2

The red sample was dyed with lack dye, due to the presence of laccaic acids. Also Acid red 8 was found in the sample.
Image 2 shows the single ion chromatogram of the components found with the mass spectrometer. The extended data is shown in Appendix II

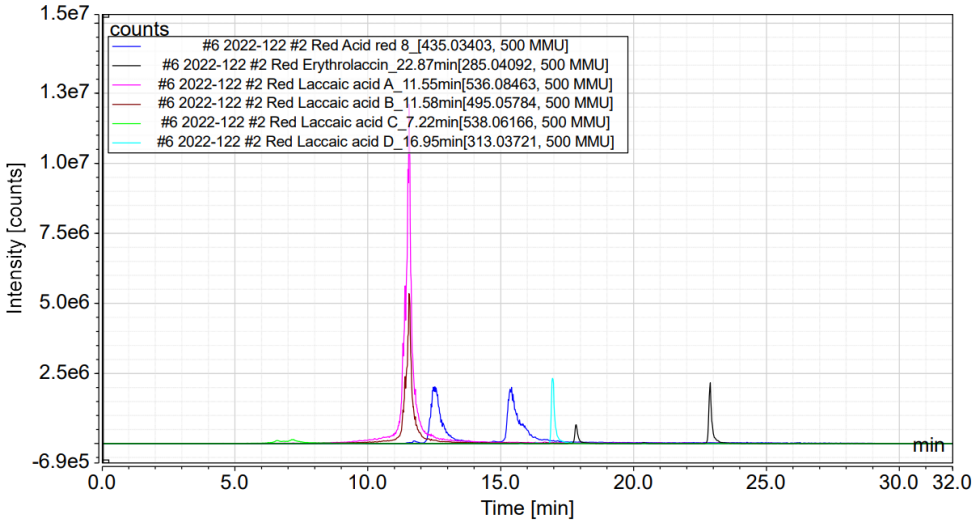


Image 2 Single ion chromatogram 2022-122#2

The presence of laccaic acid component suggest the use of lack dye (*Laccifer lacca* Cockerell.) also Acid red 8 was found. Lack dye and Acid red 8 have very similar colours and it appears that he lack dye was used for the dyeing of the silk fibres and the Acid red 8 was used for the colouring of the cotton fibres.

4.3 Sample 2022-122 #3

The bright green sample was dyed with Acid green 5. Also Acid yellow 1 was found in this sample.

Image 3 shows the single ion chromatogram of the components found with the mass spectrometer. The extended data is shown in Appendix II. In this sample the synthetic dye acid green 5 was found. Its classical is Light Green SF. This dyestuff was discovered by Köhler in 1879.
Also Acid yellow 1 was found in this sample. This yellow was discovered in 1879 by Caro.

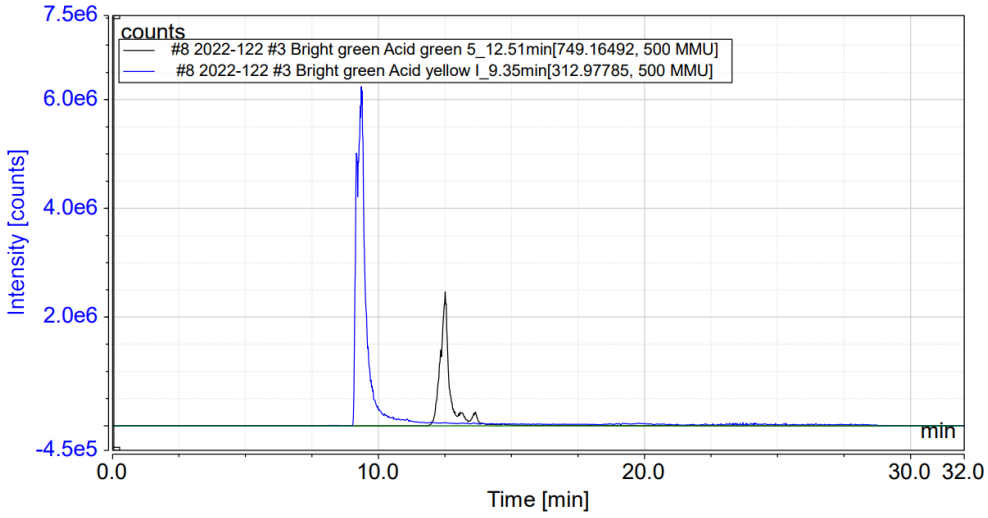


Image 3 Single ion chromatogram 2022-122#3

4.4 Sample 2022-122 #4

The orange sample was dyed with Acid orange 7, Acid yellow 1 and Acid orange 17.
Image 4 shows the PDA chromatogram of the components found. The extended data is shown in Appendix II

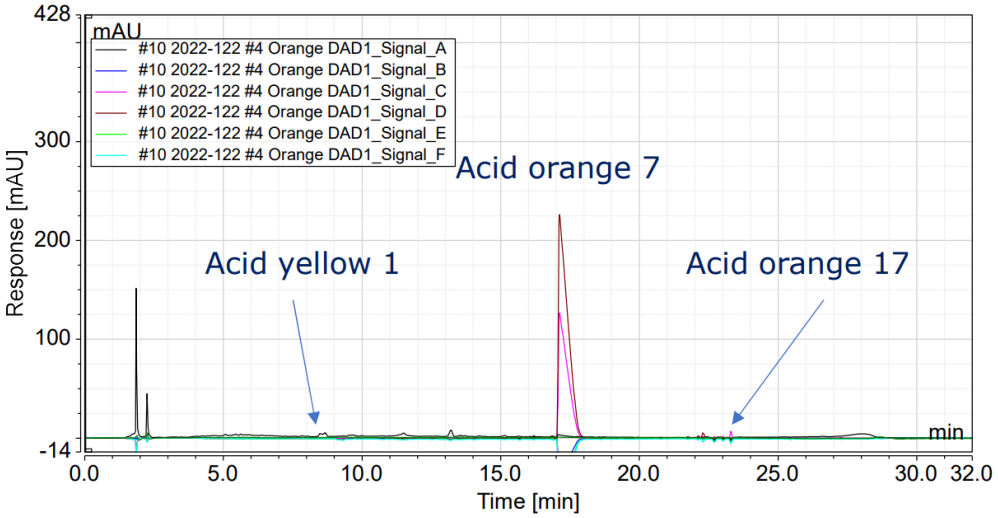


Image 4 Single ion chromatogram 2022-122#4

Acid orange 7 is the main component in this sample. This dye was patented by Z. Roussin in 1876. It's classical name is 1876.
Also Acid yellow 1 was found in this sample. Its classical name is Naphtol Yellow S and it was discovered in

Orange 17 was discovered by Levinstein Ltd. in 1879. Its classical name is Brilliant orange R.

5. Conclusion

This hip cloth was made in the last ten years of the past century. The textile is made from two fibres. One being mercerized cotton and the other silk. It appears that alum or an alum salt was used for the mordanting of the silk fibres. And in the first sample tannins were used as a mordant for the basic dyes to attach to the cotton.
The natural sources found come from Natural brown 6 (source still unsure) and Lack dye (Natural red 25).
Six synthetic dyes (Malò Siëm) were found in this object. They are: Basic violet 1, Acid yellow 1, Acid green 5, Acid orange 17, Acid red 8 and basic violet 14.

The results are in accordance with J. Kreemers book from 1922. There he explains that for the cotton threads dyeing synthetic dyes replaced the use of local natural dyes. Also Veltman in his manuscript on the Aceh's silk industry from 1912, he explains that synthetic dyes made their way to local Aceh dyeing workshops.

Appendix I: Literature

1. Cardon, D., Natural Dyes, Tradition, Technology and Science ; Archetype Publications 2007
2. Schweppe, H., Handbuch der Naturfarbstoffe, Vorkommen – Verwendung – Nachweis ; Landsberg/Lech: Ecomed, 1992
3. Society of Dyers and Colourists, American Association of Textile Chemists and Colorists, Colour Index International: Pigments and Solvent Dyes, 1997.
4. Kreemer, J., Algemeen samenvattend overzicht van land en volk van Atjèh en onderhoorigheden ; Deel 1 – 1922
5. Vetman, Th.J; Fischer, H.W. De Atjehsche zijdeindustrie naar een manuscript / Th.J. Veltman; bewerkt door H.W. Fischer. Leiden: E.J. Brill, 1911.

Appendix II

2022-122

19th century hip cloth from Aceh

LC configuration:
UHPLC-PDA-HRMS

LC method (eluents):
AFFA32

Analysis date:
17-01-2023

Data interpreted by:

Art Proaño Gaibor

Experimental

UHPLC-PDA-HRMS-AFFA
Ultra-**H**igh **P**erformance **L**iquid **C**hromatography with **P**hoto-**D**iode **A**rray and **H**igh **R**esolution **M**ass **S**pectrometry detection with **A**mmonium-**F**ormate-**F**ormic-**A**cid method

The sample was photographed with a USB microscope (Dino-Lite) at approx. 35x magnification. After extraction the analysis was carried out with an ultra-high performance liquid chromatograph with an ultraviolet visual photodiode array detector and a HESI - high resolution mass spectrometer.

Extraction
All samples were extracted in the same way. To extract the organic colorants a two-step extraction was performed:

Step 1
Each sample was placed into a 1ml Shell Vial (Thermo Fisher) and extracted with a solution of 100µl Methanol/Acetonitrile (1:1 v/v) (Sigma Aldrich LC-MS grade). The vial was inserted in a heating bloc at 70°C for 10 minutes. Then, the extract (around 50µl was separated with a gel-loading pipette into a micro-vial and stored in the dark.

Step 2
The fibre residue sample in the Shell Vial was further extracted with a 50µl solution of two parts of 35% hydrochloric acid (Acros Organics™), one part of deionized water (Honeywell MS grade) and one part of ≥99.9% methanol (LC-MS Chromasolv®-Sigma-Aldrich). The shell vial was heated in a heating bloc at 100°C for 10 minutes.
Then the acid extract was evaporated to dryness for 30 minutes under a gentle flow of nitrogen. The dried extract was then reconstituted with the previously obtained +/- 50µl extract of the micro-vial (step 1). The solution was vortexed for 1 minute. The extract was transferred with a gel-loading pipette into a new cone shaped glass micro-insert with top spring (Sigma-Aldrich) and centrifuged for 5 minutes at 700 RCF. 50µl of the DMSO extraction was transferred into a new micro-insert and this solution was analysed.

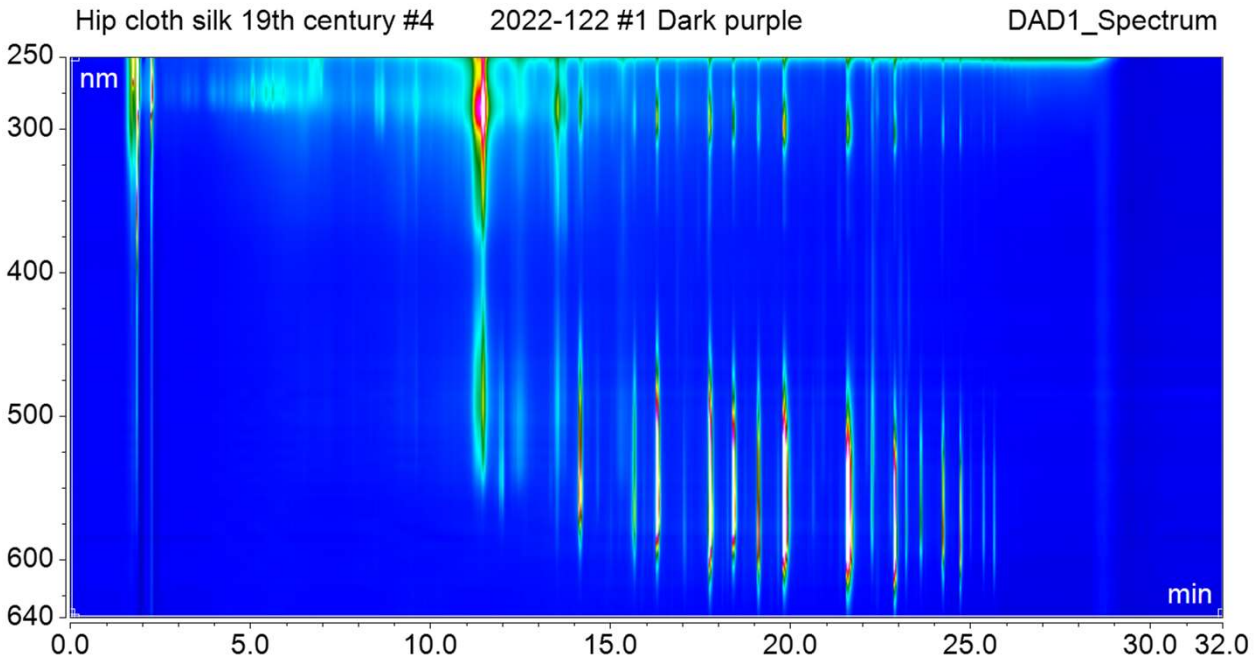
AFFA method
Analysis of the organic colorants was carried out with an ultra-high performance liquid chromatograph with photodiode array detection.
An aliquot of 5µl of the extracted sample was injected in a Waters ACQUITY UPLC H-Class System, using a Zorbax Eclipse Plus C18 Column (2.1x150mm 1.8 Micron) and a UHPLC Guard 3PK. The eluents consisted of acetonitrile (Pierce™, Thermo Fisher, LC/MS grade), methanol (Honeywell/Riedel de Haën LC/MS grade), Water (Honeywell/Riedel de Haën, LC/MS grade), 0.1% formic acid (Optima – Fisher Chemicals, LC/MS grade) and (0.5mM) ammonium formate (VWR 99%, LC/MS grade).[1]

An ultraviolet visual photodiode array (λ200-800nm) detector (PDA - Waters©) and a HESI - high resolution mass spectrometer (HRMS, Thermo Fisher Orbitrap Q-exactive) were used to record the PDA and mass spectra of the components.
Full scan MS was performed in switching polarity mode. The spray voltage was 3.8kV and the Vaporizer nitrogen temperature 350°C.
Identification of the colorants was done by matching the results with the RCE-Chromeleon database (200 entries, February 2020), using a selection from the RCE reference collection (10591 entries, March 2021).

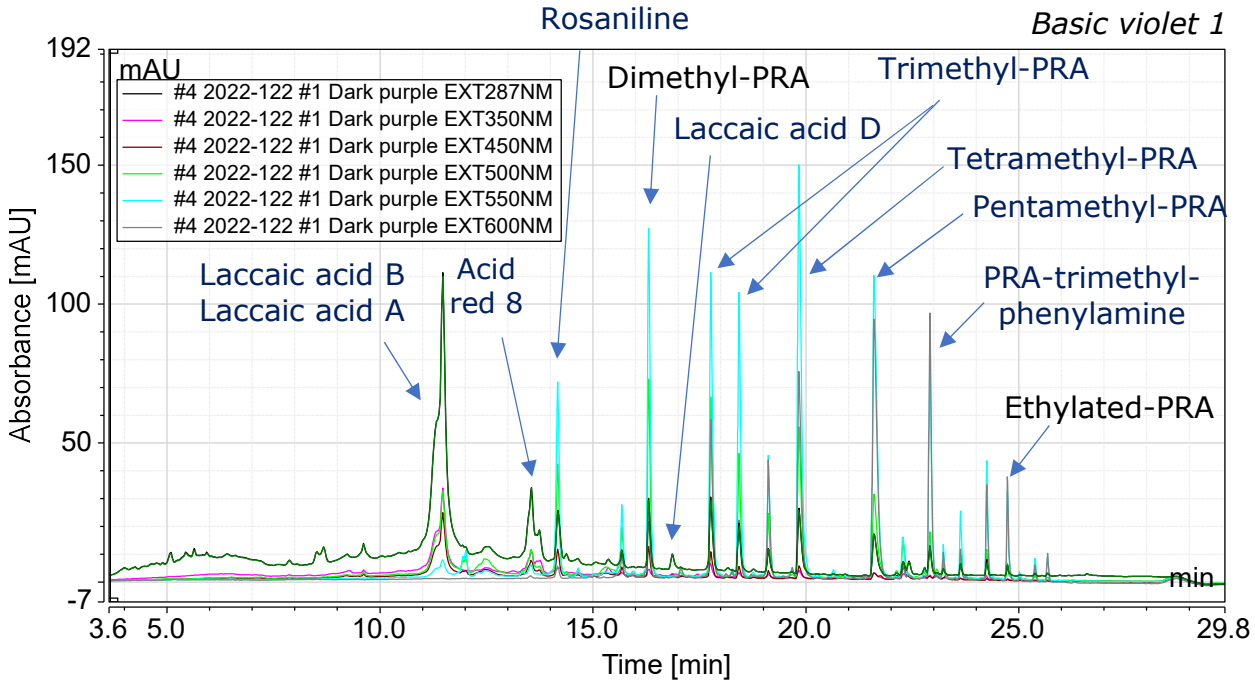
[1.] Astefanei, A., Proaño, A. and Adamson, B. Novel, Analysis method UHPLC-PDA-HRMS… to be published 2023

2022-122 #1
Dark purple

2D PDA chromatogram

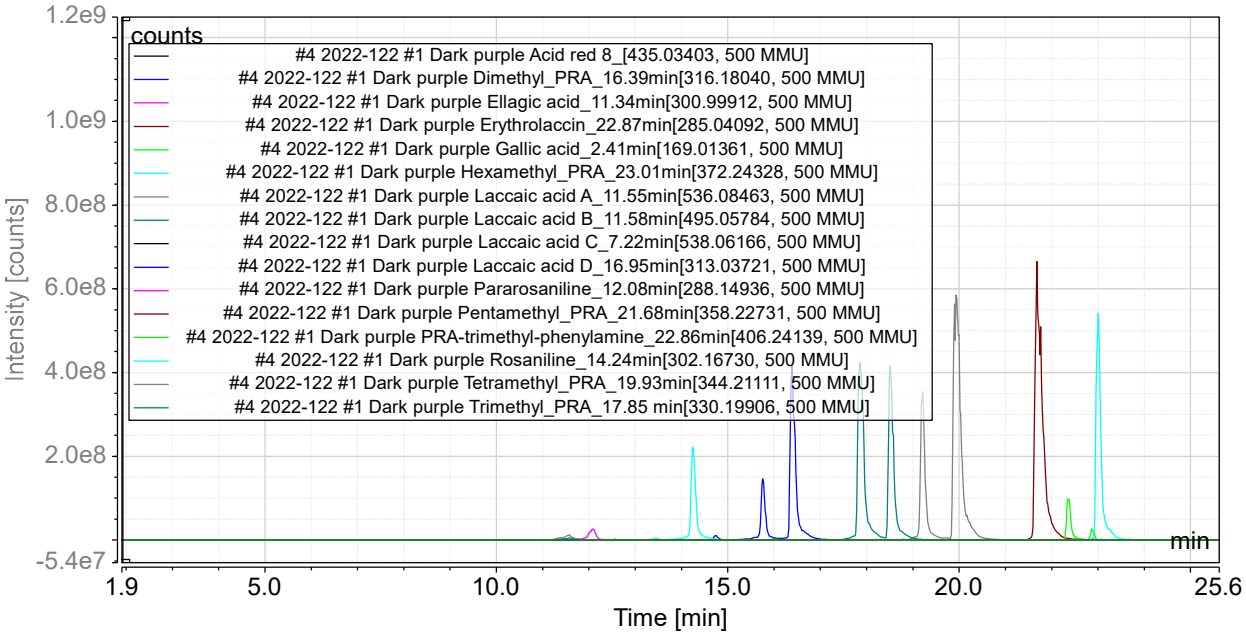


Extracted PDA chromatogram

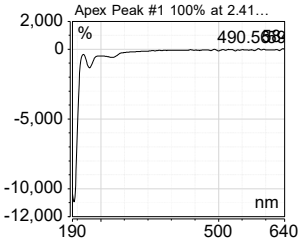
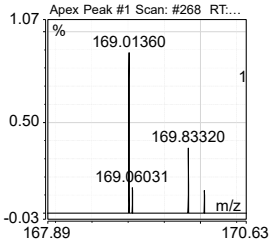
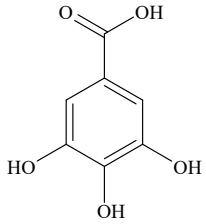
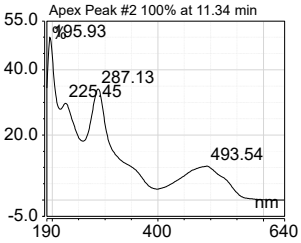
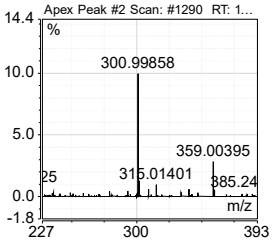
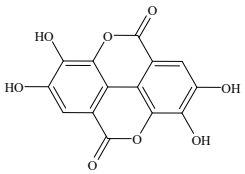
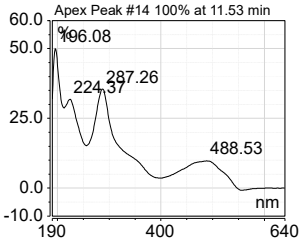
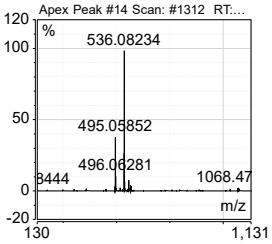
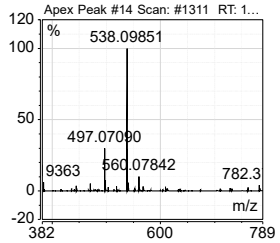
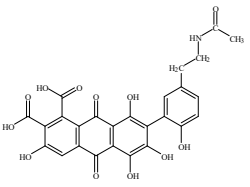


2022-122 #1
Dark purple

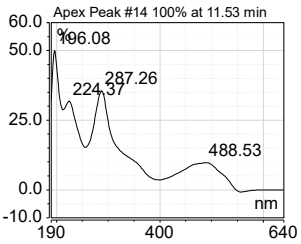
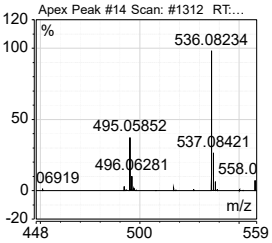
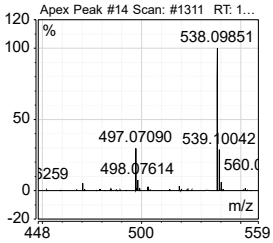
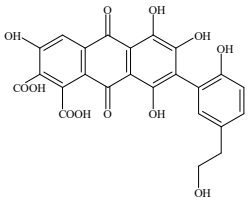
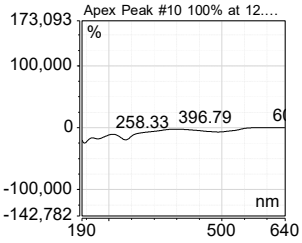
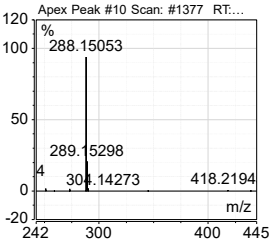
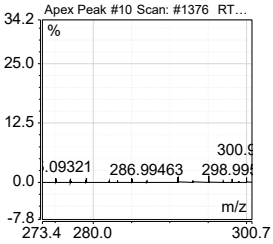
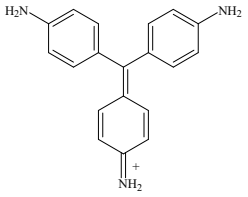
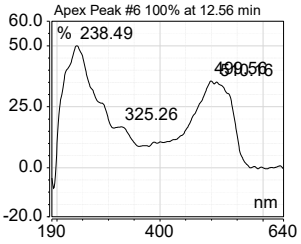
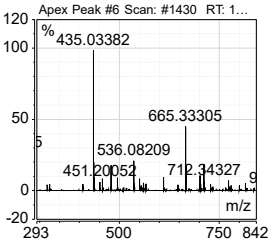
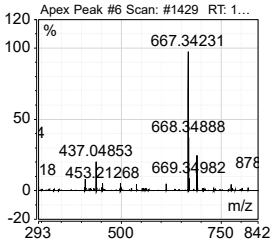
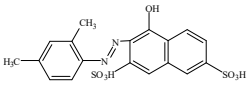
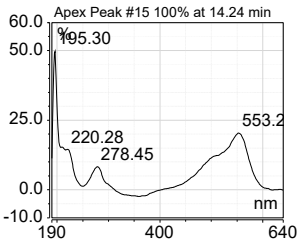
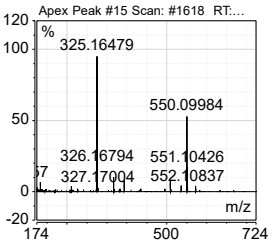
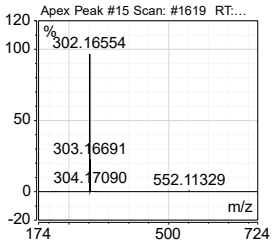
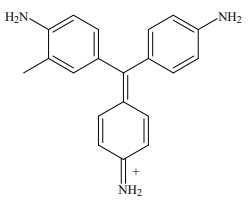
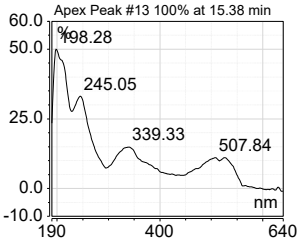
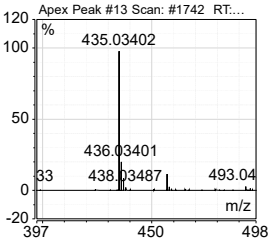
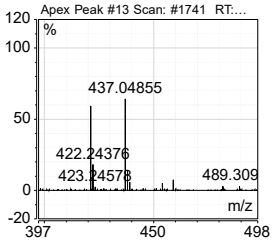
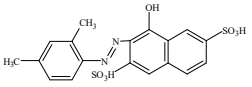
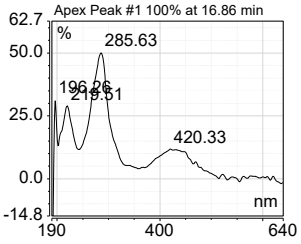
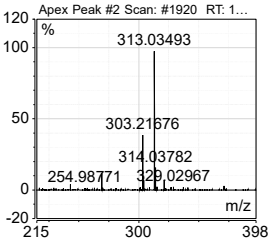
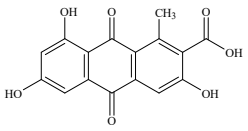
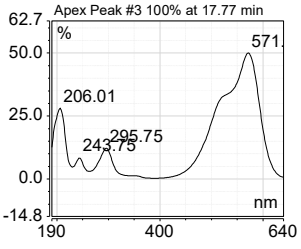
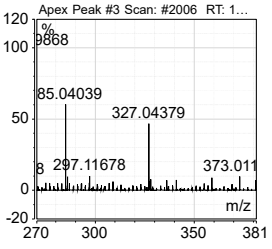
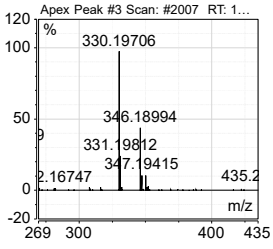
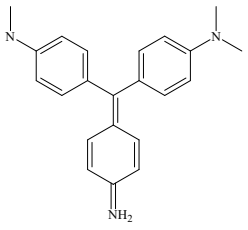
Single Ion Chromatogram



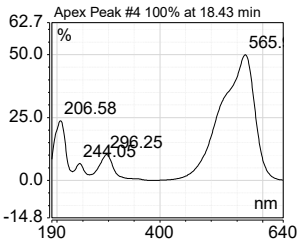
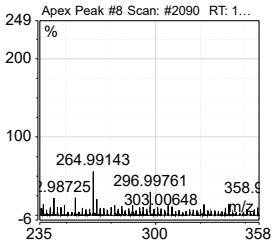
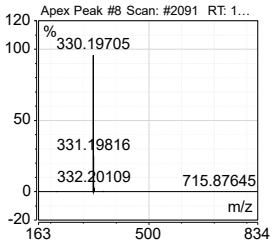
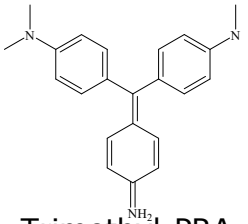
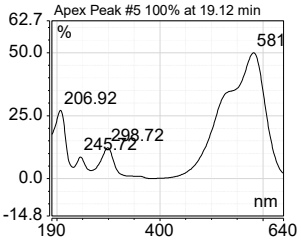
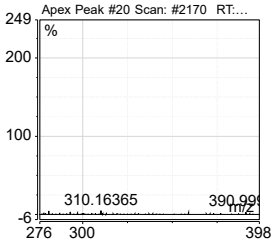
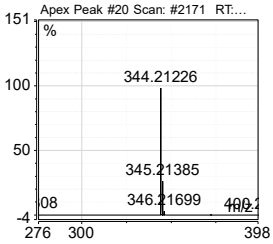
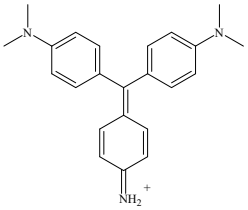
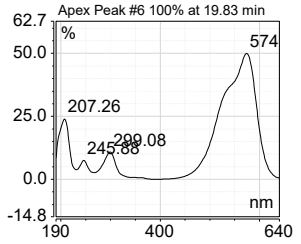
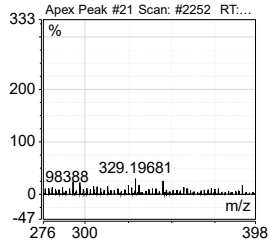
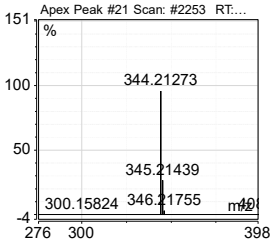
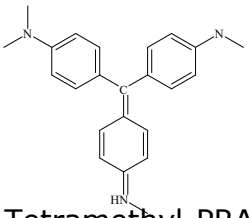
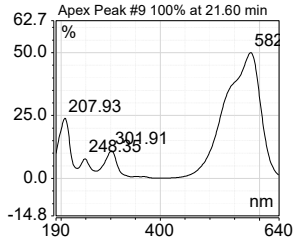
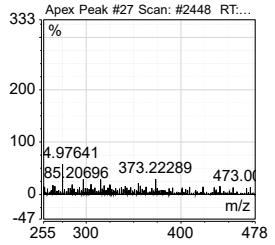
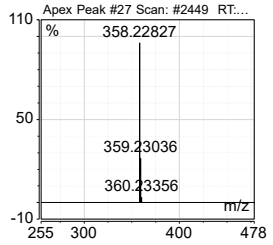
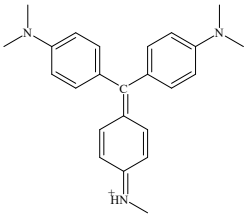
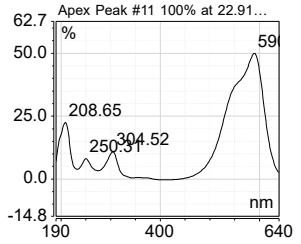
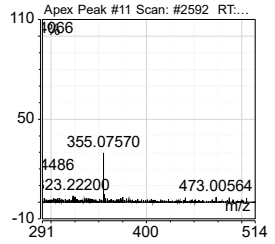
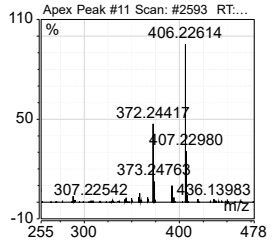
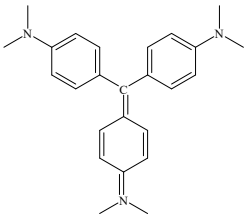
Spectrum and component table

PDA spectrum	Negative ion	Positive ion	Molecular structure
		• NA	 Gallic acid
		• NA	 Ellagic acid
			 Laccaic acid A

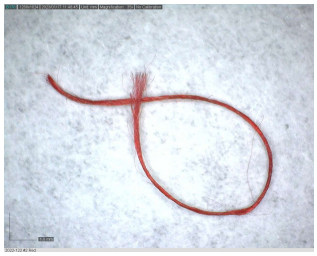
2022-122 #1
Dark purple

PDA spectrum	Negative ion	Positive ion	Molecular structure
			 Laccaic acid B
			 Pararosaniline
			 Acid red 8
			 Rosaniline
			 Acid red 8 (isomere)
		• NA	 Laccaic acid D
			 Trimethyl-PRA

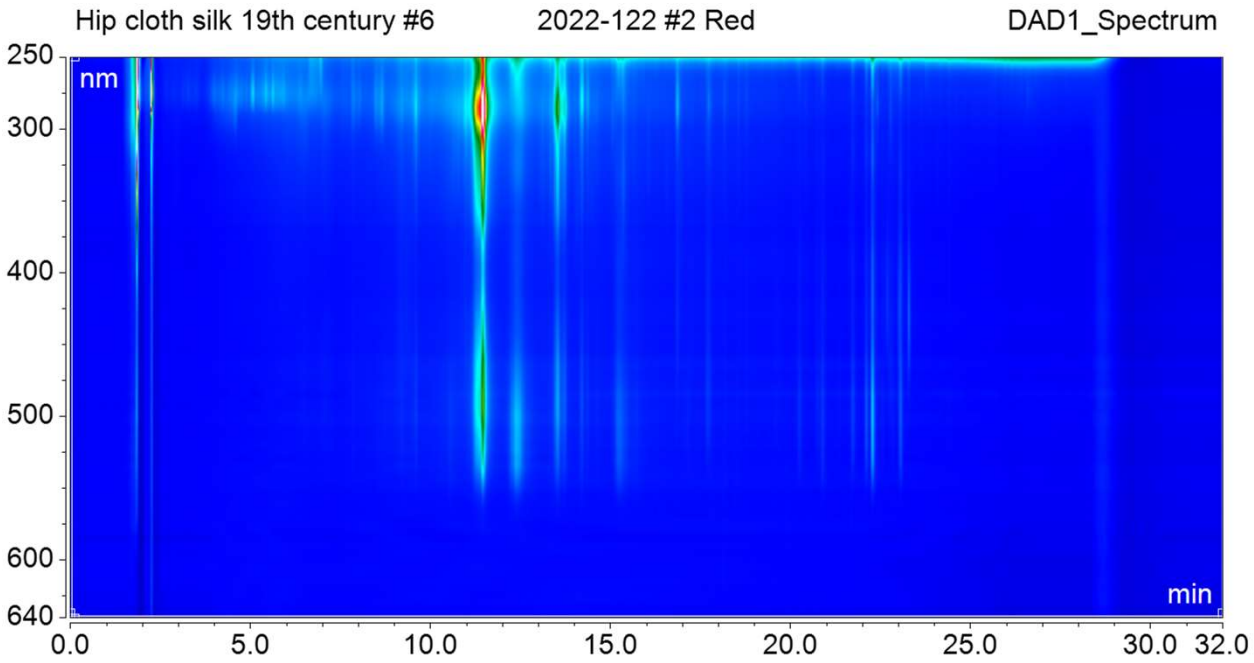
2022-122 #1
Dark purple

PDA spectrum	Negative ion	Positive ion	Molecular structure
			 Trimethyl-PRA
			 Tetramethyl-PRA
			 Tetramethyl-PRA
			 Pentamethyl-PRA
			 PRA hexamethyl/ PRA trimethyl-phenylamine

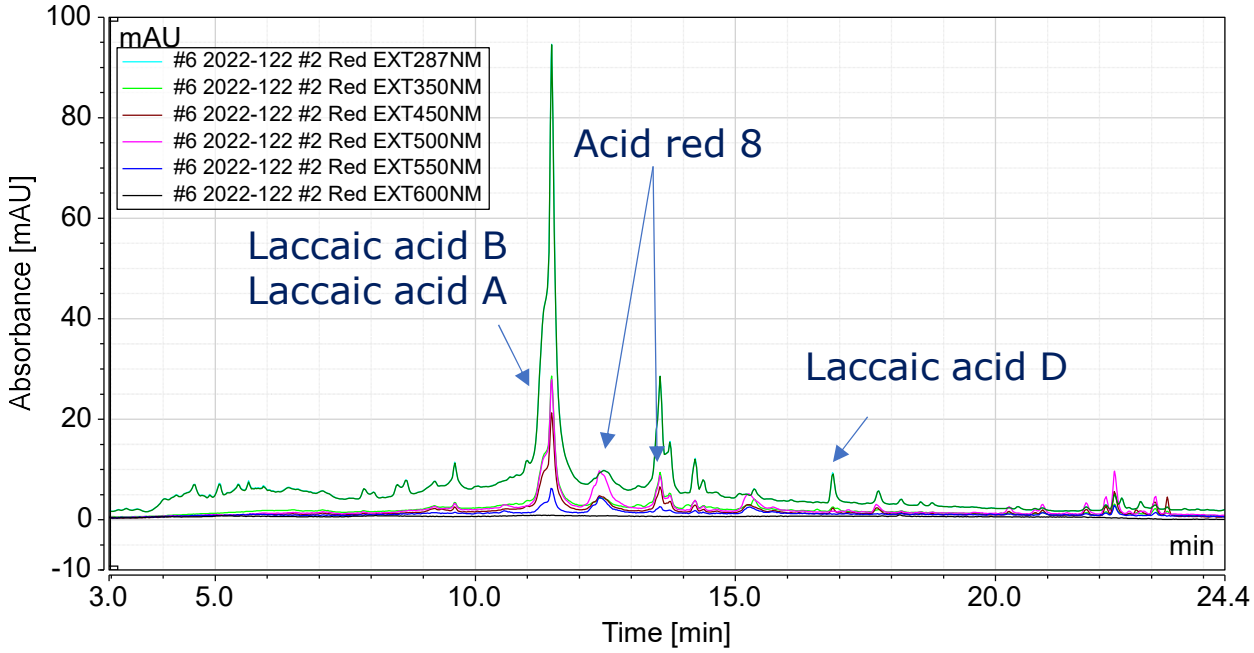
2022-122 #2
Red



2D PDA chromatogram

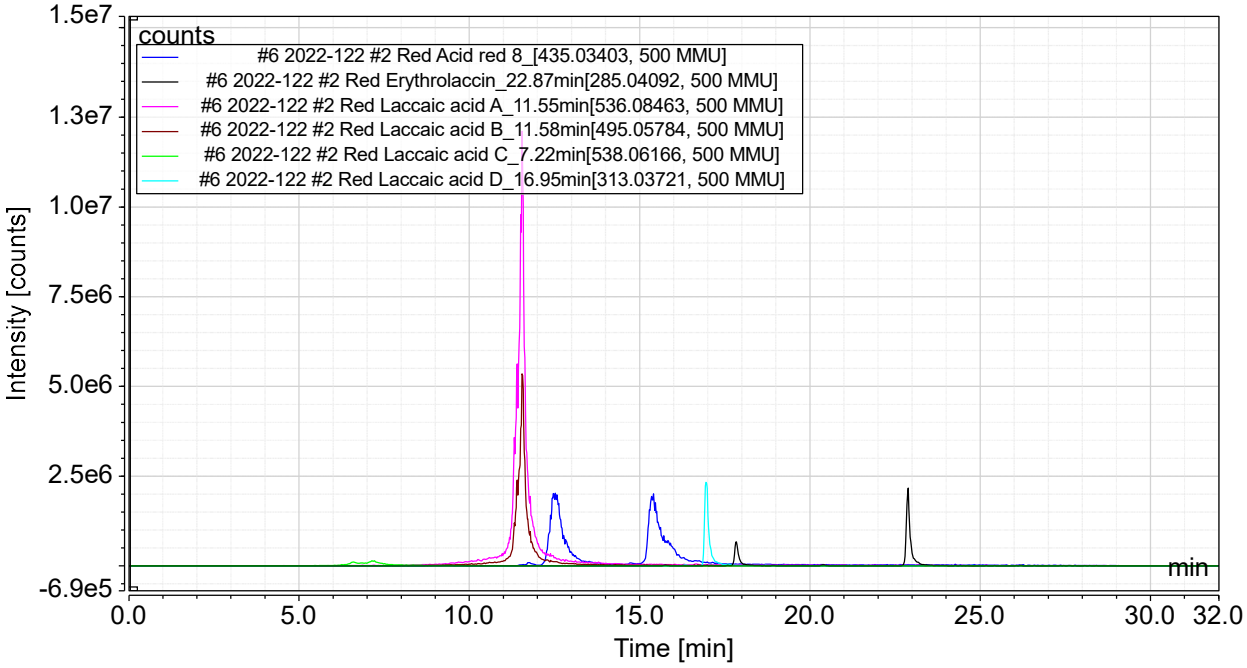


Extracted PDA chromatogram

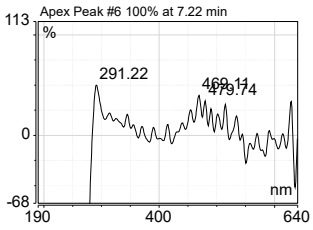
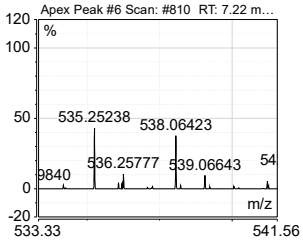
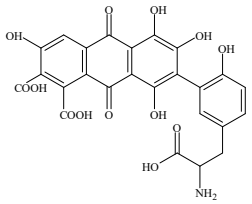
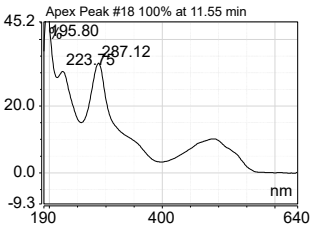
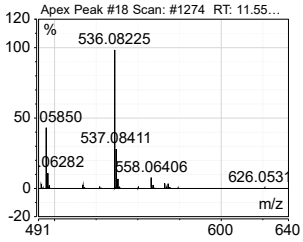
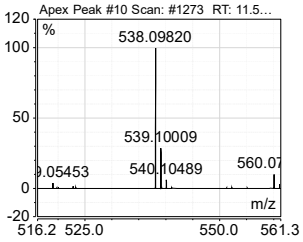
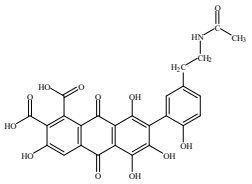
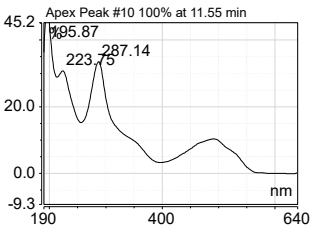
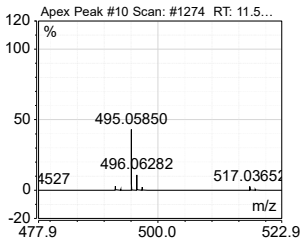
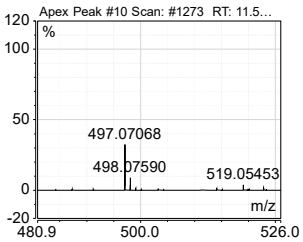
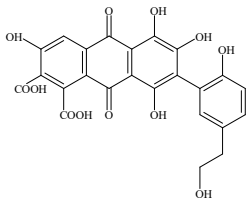


2022-122 #2
Red

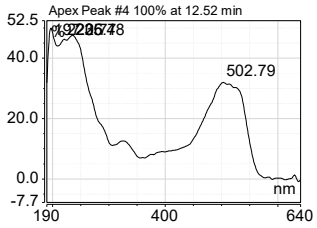
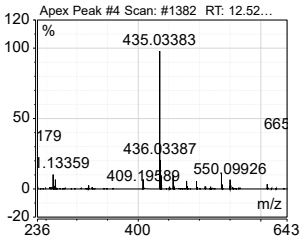
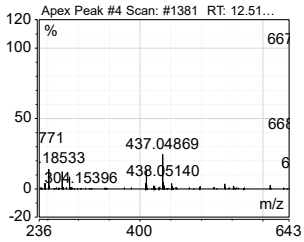
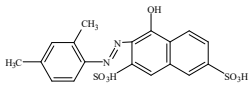
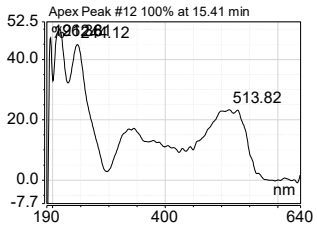
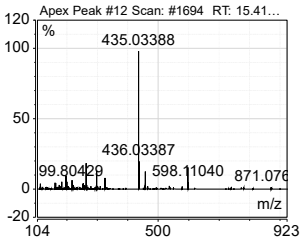
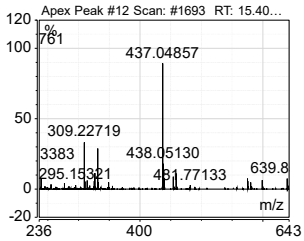
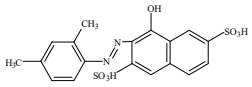
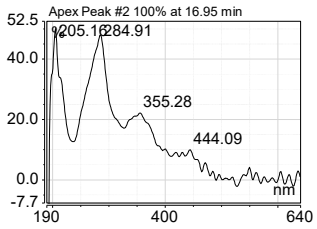
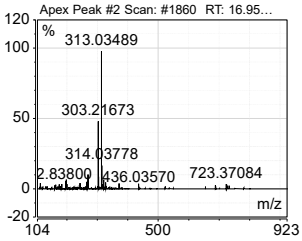
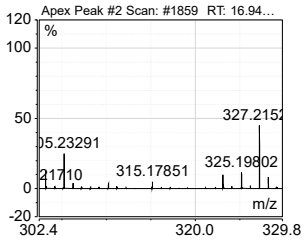
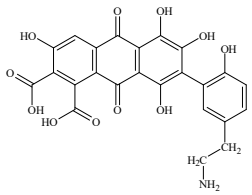
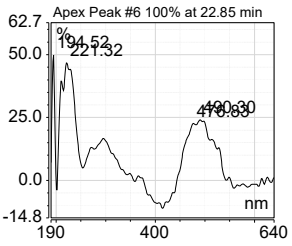
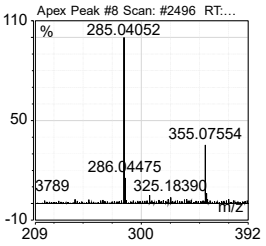
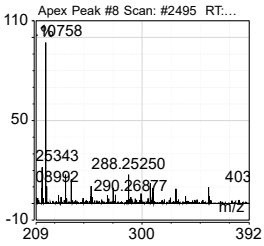
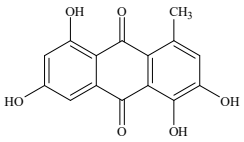
Single Ion Chromatogram



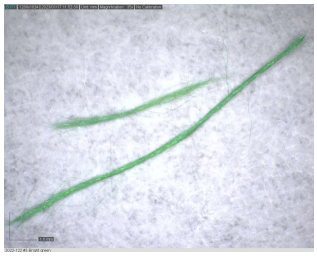
Spectrum and component table

PDA spectrum	Negative ion	Positive ion	Molecular structure
		• NA	 Laccaic acid C
			 Laccaic acid A
			 Laccaic acid B

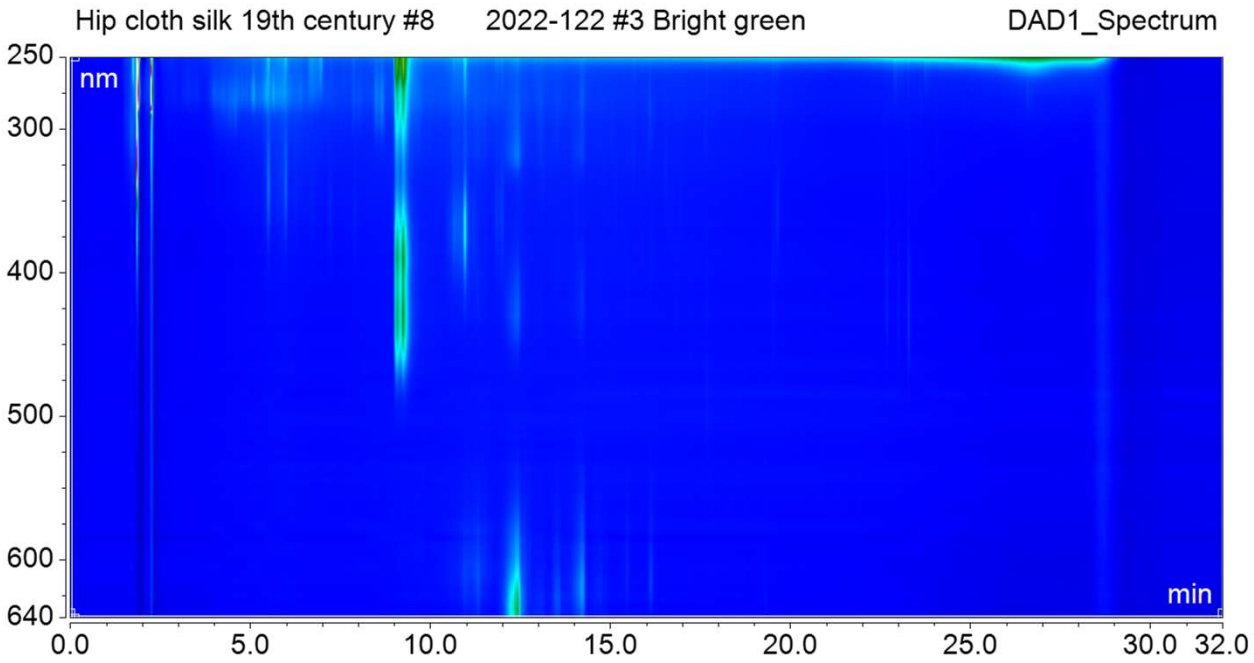
2022-122 #2
Red

PDA spectrum	Negative ion	Positive ion	Molecular structure
			
			Acid red 8
			
			Acid red 8 isomere
			
			Laccaic acid D
			
			Erythrolaccin

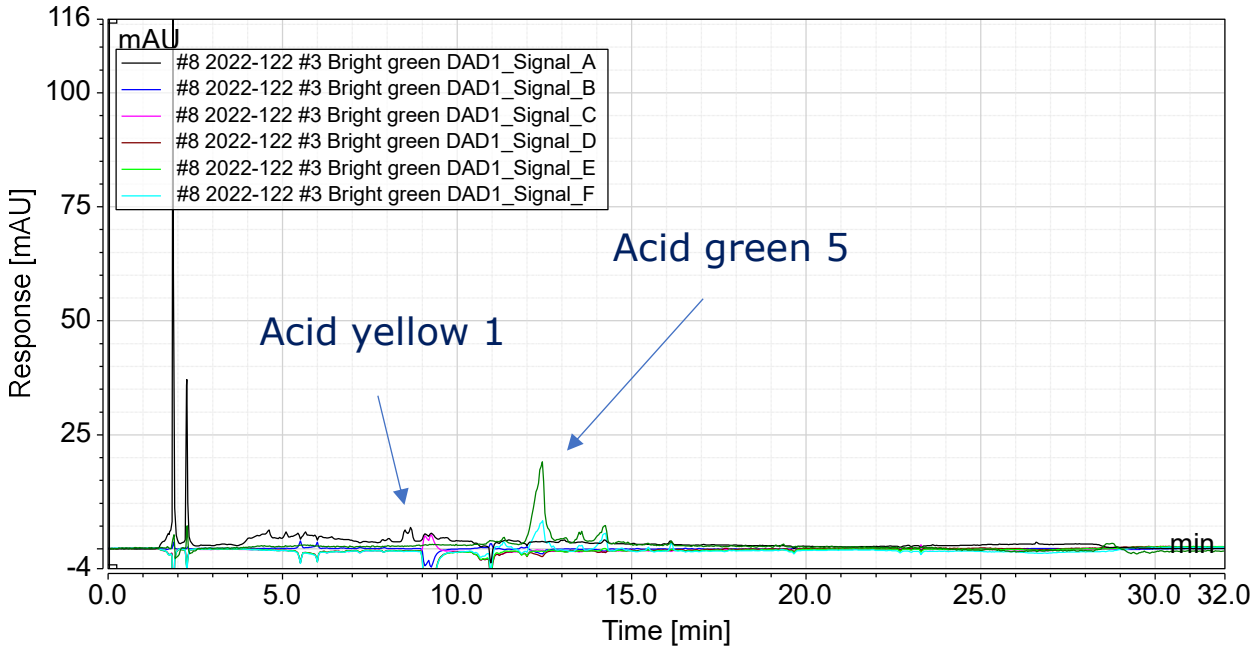
2022-122 #3
Green



2D PDA chromatogram

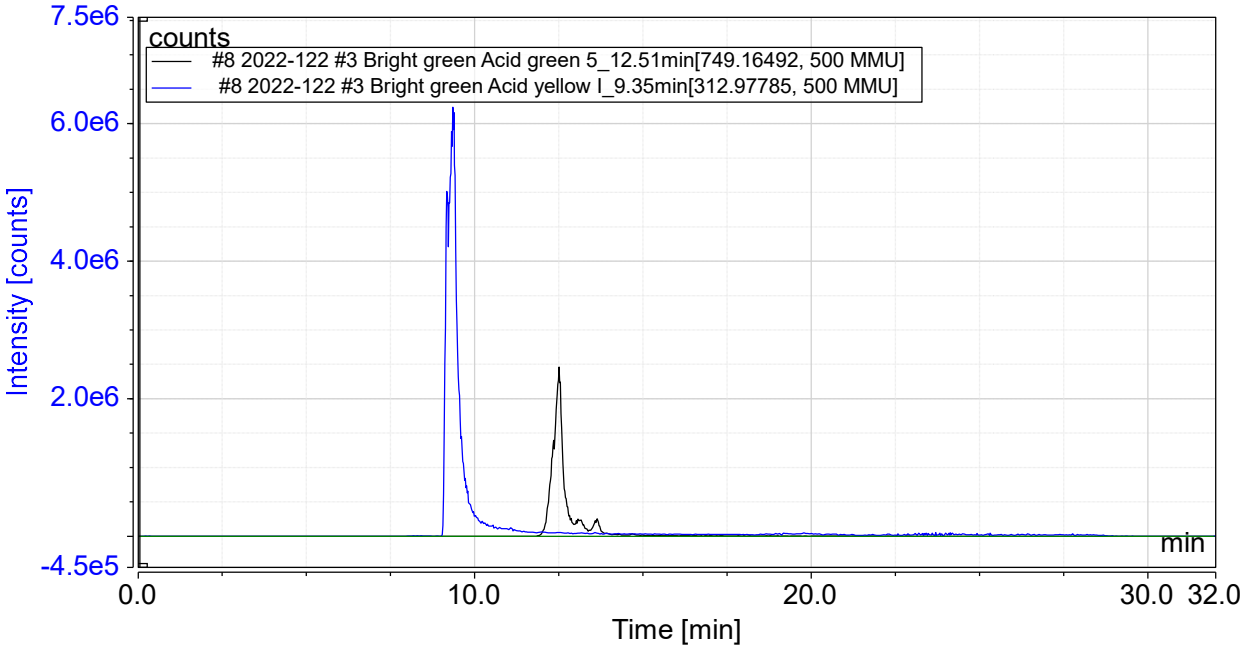


Extracted PDA chromatogram

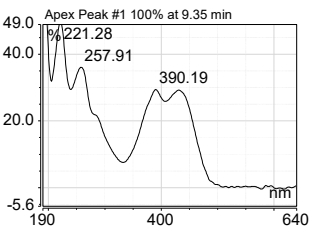
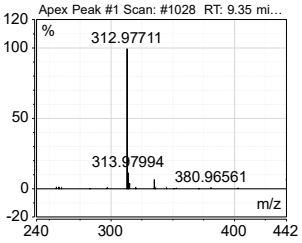
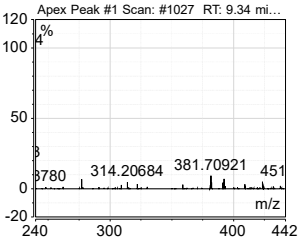
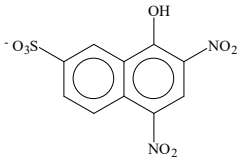
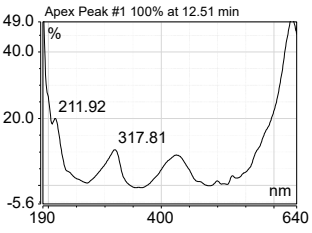
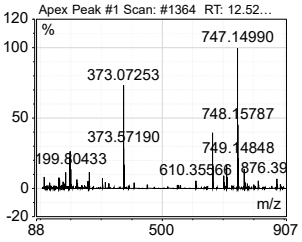
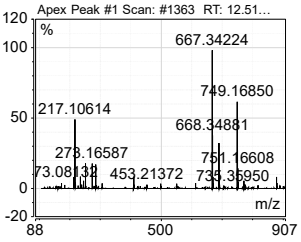
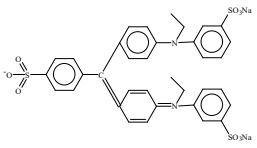


2022-122 #3
Green

Single Ion Chromatogram

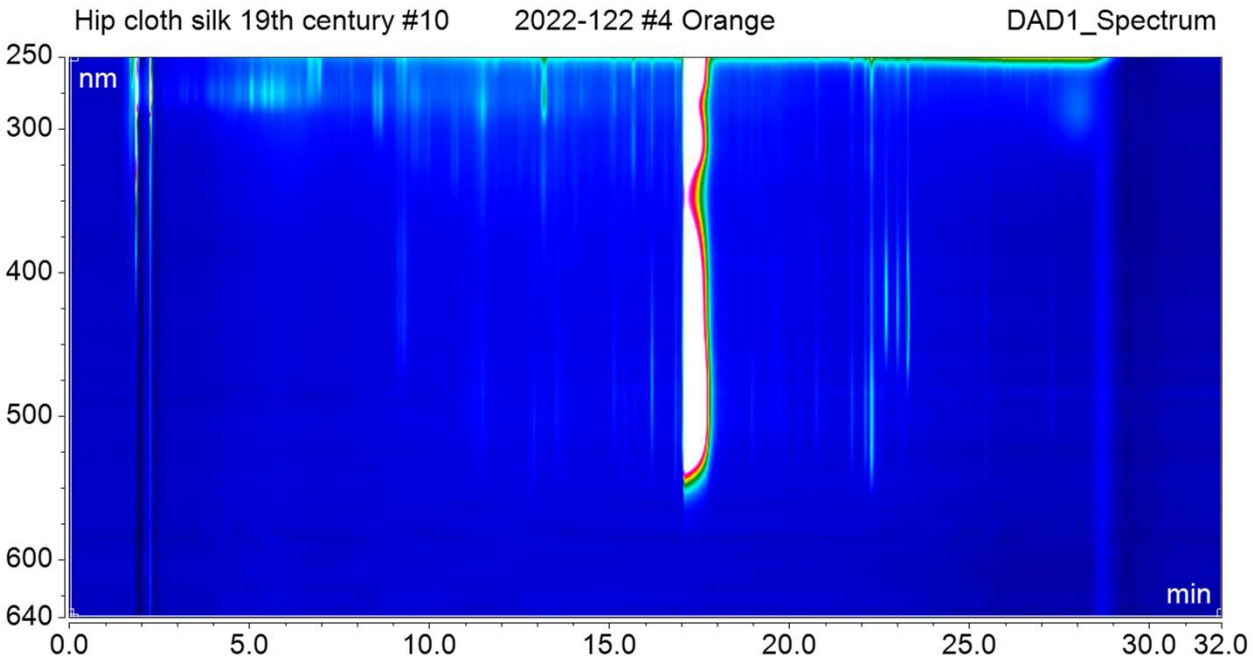


Spectrum and component table

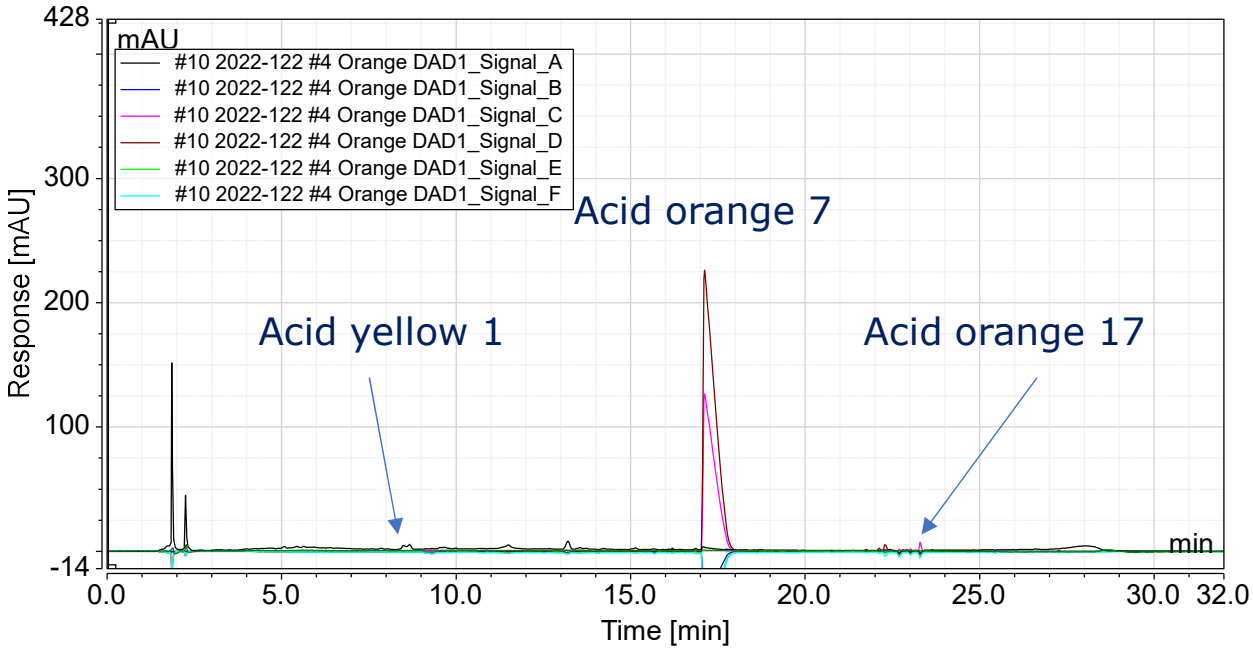
PDA spectrum	Negative ion	Positive ion	Molecular structure
			 Acid yellow 1
			 Acid green 5

2022-122 #4
Orange

2D PDA chromatogram

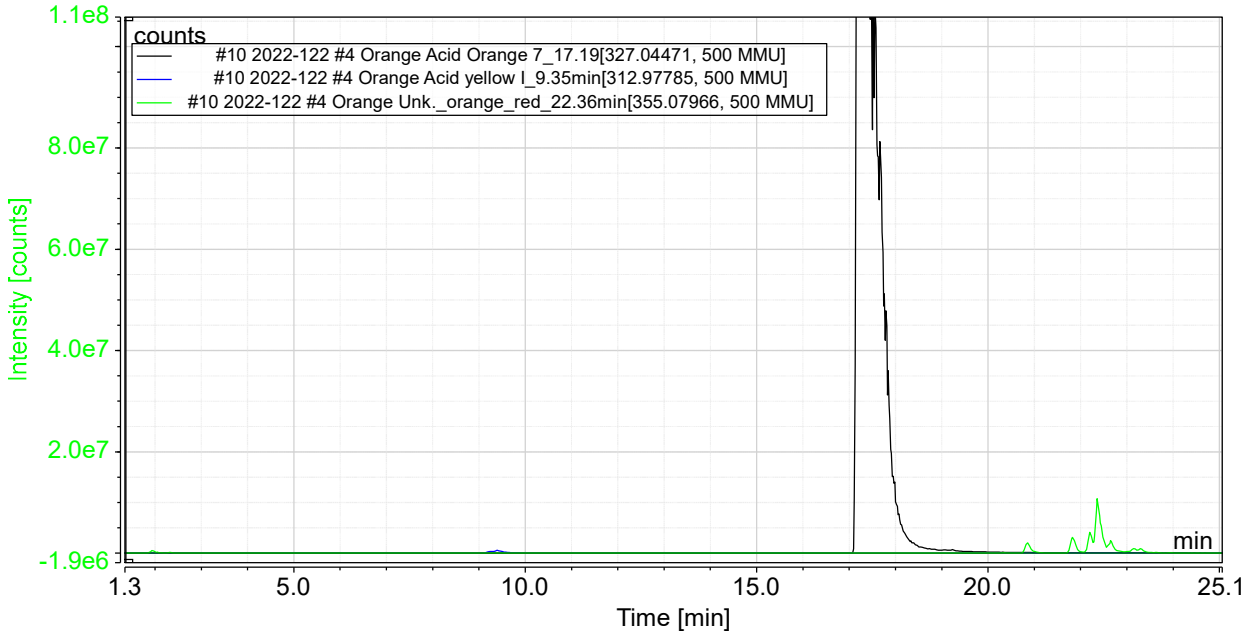


Extracted PDA chromatogram

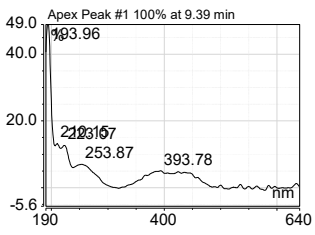
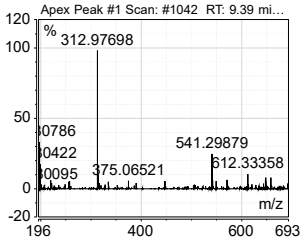
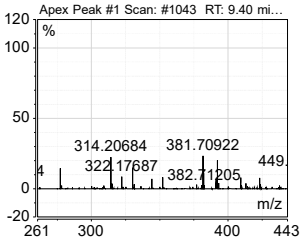
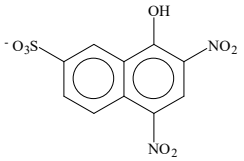
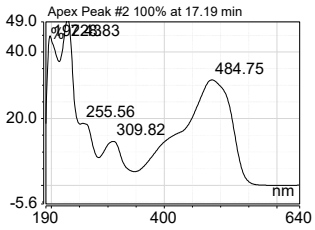
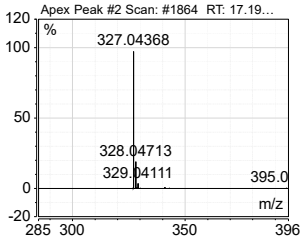
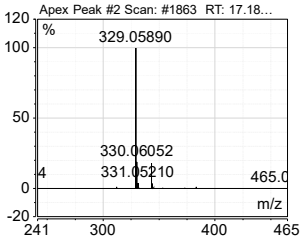
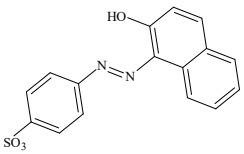
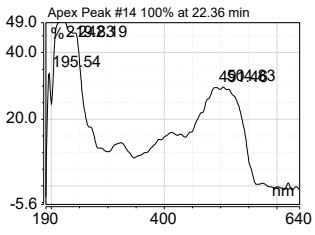
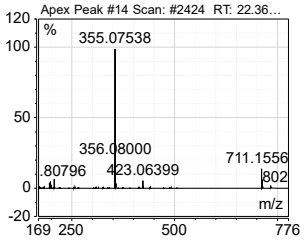
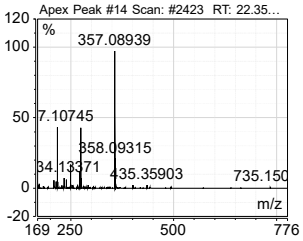
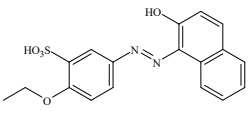


2022-122 #4
Orange

Single Ion Chromatogram

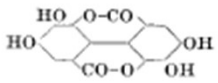


Spectrum and component table

PDA spectrum	Negative ion	Positive ion	Molecular structure
			 Acid yellow 1
			 Acid orange 7
			 Acid orange 17

75270★ **Natural Dye**

Common name **Ellagic acid**



Boil the aqueous extract of divi-divi, myrobalans or other tannins containing ellagitannin with dilute sulfuric acid or oxidise gallic acid with potassium persulfate and sulfuric acid in acetic acid solution. Formerly used for dyeing fast yellows on chromed wool. For synthesis *see* C.I.55005•

Slightly soluble in boiling water
The yellow alkaline solution turns green on addition of $FeCl_3$

Discoverer — Chevreul 1828

P & E, 399
Mayer & Cook, 200
Chevreul, *Ann. Chim. Phys.* **9** (2) (1828), 329
Braconnet, *ibid.* 187
Pélouze, *ibid.* **54**, 536
Merklein & Wöhler, *Ann. Chem. Pharm.* **55** (1845), 129
Rembold, *Ann.* **143** (1867), 288; *Ber.* **8** (1875), 1494
Löwe, *Z. für Chem.* **4** (1868), 653; *Z. für anal. Chem.* **14** (1876), 40
Ernst & Zwenger, *Ann.* **159** (1871), 32
Griessmayer, *ibid.* **160**, 55
Barth & Goldschmidt, *Ber.* **11** (1878), 846; **12** (1879), 1237
Schiff, *ibid.* 1535
Etti, *Monatsh.* **1** (1880), 226
Strohmer, *ibid.* **2** (1881), 539
Perkin & Gunnel, *JCS*, **69** (1896), 1307
Perkin, *JCS*, **71** (1897), 1137; **77** (1900), 424; **89** (1906), 259
Perkin & Wilson, *JCS*, **83** (1903), 134
Graebe, *Ber.* **36** (1903), 214
Perkin & Nierenstein, *JCS*, **87** (1905), 1416
Nierenstein, *Ber.* **40** (1907), 917; **41** (1908), 3015; cf. **42** (1909), 353
Merzig & Bronneck, *Monatsh.* **29** (1908), 263
Goldsmiedt et al, *ibid.* 263
Sisley, *Bull. Soc. chim.* **5** (4) (1909), 727
Feist & Besthorn, *Arch. Pharm.* **263** (1925), 16
Shinoda & Ping-ku, *J. Pharm. Soc. Japan*, **51** (1931), 50
Zetsche & Graef, *Helv. Chim. Acta*, **14** (1931), 240

C.I. Natural Brown 6

Aleppo Galls	**Noix de Galle**
Bahera	**Padvas**
East Indian Galls	**Shuma**
Gallapfel	**Smyrna Galls**
Galls	**Sumach**
Garan	**Tamarisk Galls**
Haritaki	**Tanners' Sumac**
Hurr Nuts	**Tannin**
Myrabolams	**Valonia**
Myrabolans	**Valonia Nuts**
Myrobalans	**White Sumac**
Divi-Divi	**Libi-Davi**
Algarobilla	
Chamarlati	**Teri**
Tari	**Touri**

Obtained from a large variety of vegetable products having a high tannin content

Algarobilla is the pods of the *Caesalpina brevifolia* of Chili. Tannin appears to be principally ellagitannin. One of the strongest tannin materials known containing on average 45%. Very suitable for both dyeing and tanning. Resembles divi-divi, the extract being liable to ferment

Amlaki, the fruit of the tree *Phyllanthus emblica* found throughout India and Burma. The fruit, bark and leaves of this tree are used for dyeing greys

Bahera, the fruit of the Indian tree *Terminalia belerica* Roxb., also found in Ceylon and Burma. Used in India for inks and for dyeing cotton in the same way as Myrobalans

Bakul, the bark of *Mimusops elengi* L., found in Bengal

Divi-divi or **Libi Davi** is the pods of *C. coriari* Willd. a W. Indian and Central American shrub. Contains 40–45% tannin, mainly ellagitannin and free ellagic acid, some combined gallic acid also present. Used similarly to galls and sumach and in dyeing blacks but to a less extent than myrobalans

Gab, the immature fruit of the tree *Diospyros embryopteris*, found in India and Burma

Galls (Aleppo, Smyrna, E. Indian, etc.) formerly much used with iron as a base for a range of greys extending from silver grey to blue black, these greys serving as the blue element in all the tertiary colours of those days. Pyrolignite of iron was used in preference to the sulphate as the acetic acid liberated did not retard the fixation of the iron tannate to the same extent as sulphuric acid

Garan, the bark of an Indian shrub, *Ceripos Roxburghiana* Arnott.

Myrobalans, the ripe fruit of *Terminalia Chebula*, a tree found throughout India and Burma

Sumach from the heartwood of the tree *Rhus cotina*, which, like *Quebracho colorado*, contains fisetin, C.I. 75620, in addition to tannin. Used like galls, Valonia, etc. to produce slates and blacks by applying the sumach and then treating with copperas, logwood being often added to the iron liquor. Sumach was often used for browns

Tamarisk Galls from various species of tamarisk grown in Arabia and Sind are much used in India on cotton and silk

Tanners' Sumac is obtained from the S. European *C. myrtifolia*

Tari, the pods of *C. digyna* or of *C. sappan*, found in India and Burma. It closely resembles **Divi-divi** but has the advantage that its aqueous extracts do not so readily begin to ferment

White Sumac is obtained from the American *R. glabra*

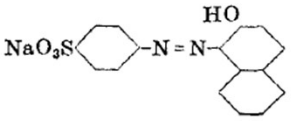
Tannin-containing materials are used with iron and/or copper salts as hair dyes; those containing both gallotannin and gallic acid are used for iron tannate inks

Literature

Parnell, 37
Napier, 248 (Galls), 258 (Sumach), 267 (Valonia Nuts), 268 (Myrabolans)
Muspratt, 580, 629
Phadke, 23, 128
Thorpe, **11**, 390
Bhattacharya, 17, 18, 19
Bhattacharya, Pal & Das, *Dyeing of Khaki on cotton*, *Govt. Bengal Dept. Industries Bull.*, 94 (1944)
Pezzo, *Cuoio, pelli mat. concianti*, **31** (1955), 71
Slater, 70 (Divi-Divi), 134 (Myrabolans)

15510 **C.I. Acid Orange 7** (*Bright reddish orange*)
15510:1 **C.I. Pigment Orange 17**
15510:2 **C.I. Pigment Orange 17:1**
15510:3 **C.I. Solvent Orange 49**

Classical name **Orange II**



Sulfanilic acid → 2-Naphthol

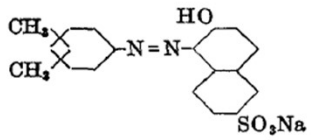
C.I. 15510:1 is the Barium salt
C.I. 15510:2 is the Aluminium salt
C.I. 15510:3 is an amine condensate

Soluble in water (reddish yellow) and in ethanol (orange)
H_2SO_4 conc. — magenta red; on dilution — brownish yellow ppt.
Aqueous solution + HCl — brownish yellow ppt;
+ NaOH — dark brown

Discoverer — Z. Roussin 1876
BIOS 961, 44
FIAT 764 — Orange II "F"
Hofmann, *Ber.* **10** (1877), 1378
Griess, *Ber.* **11** (1878), 2198
von Miller, *Ber.* **13** (1880), 268
Witt, *Chem. Zeit.* **4** (1880), 437
Mühlhäuser, *Dingl.* **264** (1887), 181
Grandmougin & Michel, *Ber.* **25** (1892), 981
Knecht and Hibbert, *Ber.* **36** (1903), 1553
Knecht, *JSDC*, **19** (1903), 171
Grandmougin, *Ber.* **39** (1906), 2495
Grandmougin, *J. prakt. Chem.* **76** (1907), 129
Ruggli & Fischli, *Helv. Chem. Acta*, **7** (1924), 496
Whitehead, *Chem. Tr. J.* **77** (1925), 33
Bucherer & Stickel, *J. prakt. Chem.* **110** (1925), 309
Seyewetz & Chaix, *Bull. Soc. chim.*, **41** (1927), 332
Keyworth, *JSDC*, **43** (1927), 349
King, *JCS*, 132 (1927), 2639
Bucherer & Rauch, *J. prakt. Chem.* **132** (1931), 227

C.I. Acid Orange	7	
CHEMICAL CLASS	Monoazo	
C.I. CONSTITUTION NUMBER	15510	
HUE		
Daylight	Bright reddish orange	
Artificial light (tungsten)	Little brighter	
DYEING: WOOL		
Method	2, 3	
Levelling	—	
S.D.C. migration test method/grade	1/5	
Staining other fibres	Cellulose and acetate—*ss*	
DYEING: OTHER FIBRES	Nylon: formic acid Silk: broken degumming liquor	
PRINTING	Direct on wool, silk and nylon	
FASTNESS PROPERTIES		
Method	AATCC	ISO
Alkali	3–4	4
Carbonising	5	4
Chlorination — alteration	—	2–3
staining wool	—	4
Decatising	5	4
Light, ¼–½ normal	4	3
normal	5	4
2× normal	6	4
Milling, alkaline — alteration	1	1
staining wool	1	1
Milling, acid — alteration	—	2–3
staining wool	—	1
Peroxide bleaching — alteration	1	1
staining wool	1	2
Perspiration	1	2–3
Potting — alteration	—	1
staining wool	—	1
Sea water — alteration	3	2
staining wool	3	1
Stoving	2	1
Washing — alteration	1–2	1
staining wool	1–2	2
OTHER PROPERTIES		
Dischargeability	Good	
Effect of metals — copper	Redder, duller	
chromium	—	
iron	Weaker, duller	
NON-TEXTILE USAGE	Biological stain and indicator. Heavy metal salts for paper coating, transparent pigments in tin printing, and in moulding powders. Paper See C.I. Pigment Orange 17 See Leather Dyes section	
NOTES		

16020 C.I. Acid Orange 17 (*Reddish orange*)



Mixed Xylidines → Schaeffer's acid

Note — *Numerous commercial variations are, or have been, made by using particular xylidine fractions or replacing part of the xylidines by toluidines or by o-anisidine, also by replacing part of the Schaeffer's acid by R acid. Examples of such mixed dyes are Ponceau GR II, R, RR, 3R and 3RL (FIAT 764).* (Compare C.I.16150, 16151, 16152)

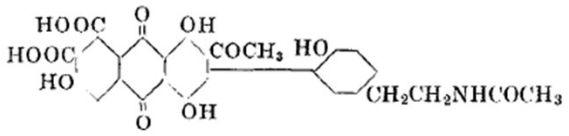
Discoverer — Levinstein Ltd. 1879
Lev., *BP* 623/79
FIAT 764 — Brillantorange R
Liebermann, *Ber.* **16** (1883), 2864

Soluble in water (orange red) and ethanol (orange)
Insoluble in benzene
H_2SO_4 conc. — red; on dilution — orange red
HNO_3 conc. — yellowish red solution
Aqueous solution + HCl conc. — orange red;
+ NaOH conc. — brownish orange

C.I. Acid Orange	17
CHEMICAL CLASS	Monoazo
C.I. CONSTITUTION NUMBER	16020
HUE	
Daylight	Reddish orange
Artificial light (tungsten)	Redder
DYEING: WOOL	
Method	3
Levelling	Moderate
S.D.C. migration test method/grade	—
Staining other fibres	Aceate—*ss*, cellulose—*u*
DYEING: OTHER FIBRES	Silk: from sulphuric acid dyebath Jute
PRINTING	
FASTNESS PROPERTIES	
Method	ISO
Alkali	4
Carbonising	4–5
Chlorination — alteration	—
staining wool	—
Decatising	4
Light, ½–¼ normal	2
normal	3–4
2× normal	3–4
Milling, alkaline — alteration	2
staining wool	—
Milling, acid — alteration	—
staining wool	—
Peroxide bleaching — alteration	—
staining wool	—
Perspiration	2
Potting — alteration	2
staining wool	—
Sea water — alteration	1–2
staining wool	—
Stoving	4
Washing — alteration	2–3
staining wool	—
OTHER PROPERTIES	
Dischargeability	Good
Effect of metals — copper	—
chromium	—
iron	—
NON-TEXTILE USAGE	Pigments and paper dyeing
NOTES	

75450 C.I. Natural Red 25

Common name **Laccaic Acid**



The solidified exudation of the insect *Coccus laccae*, growing on various trees in the E. Indies, Ceylon and the Moluccas, contains approximately 50% of laccaic acid which is extracted by dilute aqueous sodium carbonate. Dyes crimson on an alum mordant

Crookes, 354
P & E, 91
Mayer & Cook, 144
Thorpe, **VII**, 158

Aqueous solution — blood red

C.I. 75450 — C.I. Natural Red 25

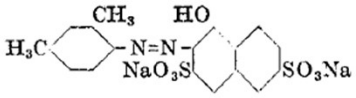
The solidified exudation of the insect *Coccus laccae* which lives on various trees in the E. Indies, Ceylon and Canary Isles. It contains approximately 50% of laccaic acid which is extracted by dilute aqueous sodium carbonate and was formerly used as a red mordant dye on wool. Its dyeing properties are very similar to those of cochineal but its dyeings have better fastness

Caked Lac · **Grained Lac** · **Gum Lacquer** · **Kade Lakh** · **Lac** · **Lac Lac** · **Lac Dye** · **Lake Lac** · **Lakh** · **Laque** · **Rangbatti** · **Seed Lac** · **Shell Lac** · **Stick Lac**

Literature

Parnell, 35
Napier, 389
Muspratt, 600
Hummel, 354
Katagiri, Mugibayashi and Morihara, *Bull. Inst. Chem. Res., Kyoto Univ.*, **18** (1949), 41
Katagiri, Mugibayashi and Omori, *ibid.*, **20** (1950), 67
Kamath and Potnis, *Paintindia*, **3** (1) (1953), 107
Lindsay & Harlow, *Report on Lac and Shellac*, Indian Forest *Records*, **8** (Part I) (1921), 66

14900 C.I. Acid Red 8 (*Bright yellowish red*)



2,4-Xylidine → 1-Naphthol-3,6-disulfonic acid

Aqueous solution + HCl conc. — magenta red;
+ NaOH conc. — weak brownish yellow

Discoverers — O. Gürke and C. Rudolph 1886
Gürke & Rudolph, *BP* 15716/85; *FP* 173007; *GP* 38281, *GP ap.* G3636, (*Fr.* **1**, 385, 386)
FIAT 764 — Cochenillescharlach PS

Soluble in water (magenta red)
Slightly soluble in ethanol (orange)
Very slightly soluble in acetone
H_2SO_4 conc. — magenta red; on dilution — pink

C.I. 14900 Monoazo — C.I. Acid Red 8

APPLICATION

DYEING

Wool Good exhaustion from a sulphuric acid and Glauber's salt dyebath
Levelling: moderate to good

Silk Dyed in the degumming liquor broken with formic or sulphuric acid

Unions Wool dyed, silk slightly stained, cellulose and acetate unstained

METHOD
Neutral ... ... ☐
Weak Acid ... ... ☐
Sulphuric Acid ... ■
Chrome in Dyebath ☐

PRINTING

Wool and Silk For direct print styles

FASTNESS PROPERTIES etc

	C
ALKALI	4
CARBONISING	5
DECATISING	4–5
LIGHT ⅓–½ Normal	3–4
Normal	5
2 × Normal	5–6
MILLING	
Alkaline	1–2
Acid	2

	C
PEROXIDE BLEACHING	3
PERSPIRATION	2–3
SEA WATER	2
STOVING	4
WASHING	
Alteration	2–3
Staining {Wool	2–3
Staining {Cotton	1–2

DISCHARGEABILITY Good
SOLUBILITY Water, good
EFFECT OF METALS Copper, little duller: Iron, little duller

HUE **Bright Yellowish Red**

ARTIFICIAL LIGHT: little change

Acilan Scarlet A ... ... **FBy**
Brilliant Cochineal PSA, 2R, 4R ... **LBH**
Brilliant Tertracid Scarlet PA ... **CT**
Solar Fast Scarlet PA ... ... **NSK**
Wool Brilliant Scarlet N ... ... **Fran**

TEXTILE USAGE

DYEING

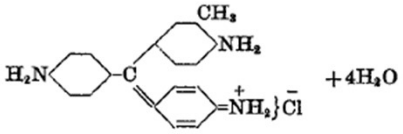
For delicate shades of pink and full scarlets on yarn and dress goods. Suitable for flannels, felts and felt hat bodies because of its good penetration

PRINTING

For direct styles on wool and silk in pinks and scarlets of good fastness to light

42510 **C.I. Basic Violet 14** (*Reddish violet*)
42510:1 **(C.I. Solvent Red 41)** is the free base
42510:2 **(C.I. Pigment Violet 4)** is the phosphotungstomolybdic acid salt

Classical names **Magenta, Fuchsine**



(*a*) Heat a mixture of aniline, *o*(and *p*)-toluidine, and their hydrochlorides with nitrobenzene, or a mixture of nitrobenzene and *o*-nitrotoluene, in presence of iron and zinc chloride (nitrobenzene process)

(*b*) Heat a mixture of aniline and *o*(and *p*)-toluidine with arsenic acid (arsenic acid process)

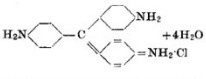
Discoverers — Natanson 1856; A. W. Hofmann 1858; Verguin 1858; Gerber and Keller 1859; Medlock 1860; Nicholson 1860; Girard and de Laire 1860; Laurent and Casthelaz 1861; Coupier 1869

Renard Frères & Franc, *FP* 46035 and 5 additions
Gerber & Keller, *FP* 42621
Medlock, *BP* 126/60; Nicholson, *BP* 184/60; Girard & de Laire, *BP* 1300/60; *FP* 44958
Laurent & Casthelaz, *FP* 52223
FIAT 1313, **2**, 330
Natanson, *Ann.* **98** (1856), 297
A. W. Hofmann, *Jahresber.* **4** (1858), 353; *J. prakt. Chem.* **77** (1859), 190; **87** (1862), 226
Coupier, *Jahresber.* **15** (1869), 568; *Ber.* **6** (1873), 25, 423, 1072
Schmidlin, *Compt. rend.* **139** (1904), 676
Lambrecht, *Ber.* **40** (1907), 247
Wales & Nelson, *JACS*, **45** (1923), 1662
Holmes, *Ind. Eng. Chem.* **17** (1925), 59
Michaelis & Granick, *JACS*, **67** (1943), 1212

H_2SO_4 conc. — yellow brown; on dilution — almost colourless
Aqueous solution + NaOH — almost colourless with red ppt.

Soluble in cold and hot water (red violet)
Very soluble in ethanol (red)

X.—Triphenylmethane and Diphenylnaphthylmethane Colouring Matters

No.	*Commercial Name*	*Scientific Name—Components—Formula*	*Preparation*	*Discoverer—Literature*
676 (511)	**Para Magenta** (H) (HP) **Para Roseine** (HP) **Fuchsine** (TMC); **NJ** (DH) **Para Rosaniline Base** (HP) (GrE) (K) The obsolete dye **Aldehyde Blue**, discovered by **Lauth**, was obtained by the action of paraldehyde on pararosaniline in presence of a mineral acid (Gatterman and Wichmann, Ber. 1889, **22**, 227). In 1862, **Cherpin** obtained the first synthetic green dye, **Aldehyde Green** or **Usèbe Green**, by the action of sodium thiosulphate on **Aldehyde Blue** (von Miller and Plöchl, Ber. 1891, **24**, 1709). **Aldehyde Green** was used largely for dyeing silk and wool but was soon replaced by **Iodine Green** (No. 686)	Hydrochloride of pararosaniline*, or hydrochloride of triamino-triphenylcarbinol anhydride, or diamino-fuchsonimonium chloride **Components**— Aniline and *p*-Toluidine Hydrochloride—$C_{19}H_{16}N_3Cl + 4H_2O$ Acetate—$C_{19}H_{16}N_3{\cdot}C_2H_3O_2$  *The dichloro-derivative of pararosaniline, obtained from *p*-aminobenzaldehyde and *o*-chloroaniline, dyes cotton mordanted with tannin and tartar emetic a bluer shade than pararosaniline and also possesses therapeutic properties for the treatment of diseases, such as sleeping sickness, caused by trypanosomes (L. Cassella & Co. E.P. 14742[25], F.P. 456498, G.P. 264942)	(1) Heat a mixture of aniline and *p*-toluidine and their hydrochlorides with iron or ferrous chloride and nitrobenzene (**Coupier** 1869) (2) Oxidise a mixture of aniline and *p*-toluidine with arsenic acid (**Rosenstiehl** 1869) (3) Condense 1 molecular proportion of *p*-nitrobenzaldehyde with 2 molecular proportions of aniline sulphate in presence of zinc chloride, and heat the *p*-nitro-diamino-triphenylmethane formed with ferrous chloride at 160-180° C. (**O. Fischer** 1880) (4) Heat pure aniline with *p*-nitrobenzyl chloride in presence of iron filings or iron salts (**Greiff and Baum**) (5) Heat *pp'*-diamino-triphenylmethane or anhydroformaldehyde-aniline with aniline and aniline hydrochloride in presence of nitrobenzene and ferric chloride (**Walter** 1887; **Homolka** 1889) (6) Oxidise triaminotriphenylmethane in acetone or alcoholic solution (7) Heat pure aniline with carbon tetrachloride (used on a manufacturing scale by **Monnet and Dury**, Lyons) 50 parts of anhydroformaldehyde-aniline (obtained by the interaction of equimolecular proportions of aniline and 40% formaldehyde) are heated on the water-bath with 100 parts of aniline and 70 parts of aniline hydrochloride. The mixture is rendered alkaline with sodium hydroxide, distilled with steam to remove unaltered aniline, and the residue of diamino-diphenylmethane is crystallised from alcohol in leaflets, m.p. 89° C.; 20 parts of diamino-diphenylmethane are heated with 50 parts of aniline, 10 parts of aniline hydrochloride, 10 parts of nitrobenzene and 5 parts of powdered ferric chloride at 170° C. for several hours. The excess of aniline and nitrobenzene is removed by distillation with steam, the residue is acidified with hydrochloric acid, boiled and filtered. The pararosaniline hydrochloride separates from the filtrate in small green crystals on cooling, and further quantities are obtained by concentrating the mother liquor—(Möhlau and Bucherer)	Hoechst Farb. E.P. 1212[23], U.S.P. 252202, G.P. 16766; E.P. 2067[89], G.P. 61146; U.S.P. 248154, F.P. 141077, G.P. 16750 Greiff, G.P. 15120, 19304 Baum, E.P. 6000[96], G.P. 41929 Rosenstiehl, Bull. Soc. Ind. Mulhouse, 1866, **36**, 264; Dingl. 1867, **181**, 389; Ann. Chim. Phys. (5), **8**, 192 Caro and Graebe, Ber. 1878, **11**, 1117 E. and O. Fischer, Ann. 1878, 194, 242; Ber. 1878, **11**, 1079; 1880, **13**, 2204 O. Fischer, Ber. 1882, **15**, 678 E. Fischer and Jennings, Ber. 1893, **26**, 2221; cf, J.S.D.C. 1893, **9**, 214 Eberhardt and Welter, Ber. 1894, **27**, 1814 Walter, Bull. Soc. Ind. Mulhouse, 1895, **65**, 82 Miolati, Ber. 1895, **28**, 1697 Baeyer and Villiger, Ber. 1904, **37**, 2857 Knecht, J.S.D.C. 1905, **21**, 292 Baeyer, Ber. 1905, **38**, 579 Hantzsch, Ber. 1905, **38**, 2148 Lambrecht, Ber. 1907, **40**, 247; cf, J.S.D.C. 1907, **23**, 125 Lifschitz, Ber. 1919, **52**, 1919; cf J.S.D.C. 1920, **36**, 23 Wieland and Schening, Ber. 1921 **54**, 2527 Manual 465

(b) Triamino-Derivatives of Triphenylmethane

Description—Properties—Mode of Application
Appearance—glistening cantharides crystals, rather more compact than ordinary **Magenta crystals** (No. 677).
Spectrum in water—λ = 543·9 and 487·1.
Water—sparingly soluble cold with a red colour, more readily soluble hot.
Alcohol—readily soluble with a crimson colour. **HCl to aqueous solution**—yellow solution. **NaOH**—reddish crystalline precipitate of pararosaniline base. **H_2SO_4**—yellow solution, pale yellow solution on dilution.
Dyes—wool, silk and leather direct, and cotton mordanted with tannin and tartar emetic, red.
Fastness—similar to that of **Magenta** (No. 677).
Used only for the manufacture of **Diphenylamine Blue** (No. 688).

C.I. Basic Violet	**14**	
CHEMICAL CLASS	Triarylmethane	
C.I. CONSTITUTION NO.	42510	
SUBSTRATE	SILK	ACRYLIC
HUE	Bright Reddish Violet	Bright Reddish Violet
Artificial Light (tungsten)	yellower	yellower
RESERVATION IN DYEBATH		
cotton	2	—
viscose	2	—
wool	2	—
nylon (type)	4	—
polyester	—	—
FASTNESS		
TEST METHODS	ISO	AATCC
Light — source	daylight	—
pale	1	—
medium	1	4–5
heavy	2	—
Perspiration — acid/alk.	alkaline	alkaline
change	3–4	5
staining	2	—
Pleating (steam) — conditions	—	—
change	—	—
staining	—	—
Pressing (dry) — conditions	—	—
change	5	—
after 2–4 hr	—	—
staining	—	—
Washing — conditions	ISO 1	III
change	2	5
staining	3–4	—
NOTES ON APPLICATION AND USAGE	**Cotton** (tannin mordant) Direct printing and dyeing on discharged tannin mordant Fastness: light (B*), 1, 1, 1; (A*), 1 washing (A*), 2 **Wool** Fastness C*: light, 1, 1, 2; washing, 2–4, 5 **Bast fibres** **Paper**—widely used **Pigments**—with high mol. wt. acids are red to bordeaux pigments. For printing inks, crayons etc. Generally poor fastness except for C.I. Pigment Violet 4 **Distempers**—on china clay **Leather** **Photography**—filter dye **Spirit Inks** etc Free base—C.I. Solvent Red 41	

42535 **C.I. Basic Violet 1** (*Bluish violet*)
42535:1 **(C.I. Solvent Violet 8)** is the free base
42535:2 **(C.I. Pigment Violet 3)** is the phosphotungstomolybdic acid salt
42535:3 **(C.I. Pigment Violet 27)** is the copper ferrocyanide complex

Classical name **Methyl Violet**

A mixture of the hydrochlorides of the more highly methylated pararosanilines, containing principally the *N*-tetra-, penta-, and hexamethyl derivatives, obtained by oxidation of *N,N*-dimethylaniline with cupric chloride, or by the action of air on an intimate mixture of *N,N*-dimethylaniline, phenol, sodium chloride, and copper sulfate

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Soluble in cold and hot water (violet)
Very soluble in ethanol (violet)
H_2SO_4 conc. — orange; on dilution — green ppt.
Aqueous solution + NaOH — brown red and ppt.

Discoverer — Lauth 1861. Placed on the market by Poirrier and Chappat 1866

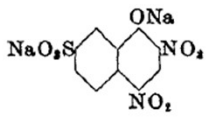
Lauth, *BP* 3195/66; *FP* 71970
FIAT 1313, **2**, 314
FIAT 764 — Methylviolettbase
Lauth, *Mon. sci.* (1861), 336; (1866), 1033
A. W. Hofmann, *Ber.* **6** (1873), 352
E. and O. Fischer, *Ber.* **11** (1878), 2098; **12** (1879), 2350; *Ann.* **194** (1878), 295
Crossley, *JACS*, **41** (1919), 2084
Briggs, *JSDC*, **37** (1921), 291
Kober, *Ind. Eng. Chem.* **15** (1923), 837
Holmes, *Ind. Eng. Chem.* **17** (1925), 918

Fanal Violet RM (IG)

Pigment for printing inks, consisting of the copper ferrocyanide lake of C.I.42535

M. Michels, *BP* 407856; *GP* 657740 (*Fr.* **24**, 607)
BIOS 961, 29. *BIOS* 1661, 19
FIAT 764 — Fanalviolett RM Plv.

C.I. Basic Violet	1		
CHEMICAL CLASS	Triarylmethane		
C.I. CONSTITUTION NO.	42535		
SUBSTRATE	COTTON (tannin mordant)		WOOL
HUE	Bluish Violet		Bluish Violet
Artificial Light (tungsten)	redder		—
RESERVATION IN DYEBATH			
cotton	—		—
viscose	—		—
wool	—		—
nylon (type)	—		—
polyester	—		—
FASTNESS			
TEST METHODS	B*	A*	C*
Light source	day.	day.	daylight
pale	1	—	1
medium	1	1–2	1
heavy	1	—	1
Perspiration acid/alk.	—	—	—
change	1–2	4–5	—
staining	—	—	—
Pleating conditions	—	—	—
(steam) change	—	—	—
staining	—	—	—
Pressing conditions	—	—	—
(dry) change	3	3	—
after 2–4 hr	—	—	—
staining	—	—	—
Washing conditions	—	—	—
change	1–2	3–4	4
staining	—	—	4
NOTES ON APPLICATION AND USAGE	Dyeing also on bast fibres, silk Printing of cotton, silk, wool and dyeing on discharged tannin mordant (cotton) **Major usage** of this dye is non-textile **Pigments** with high mol. wt. acids *see* C.I. Pigment Violet 3 **Paper**—widely used **Leather** **Distempers, Plastics** **Biological Stain, Indicator** **Photographic filters** **Spirit Inks, Lacquers** **Wood Stains** **Solvent dye**—free base used *See* C.I. Solvent Violet 8		



Also as K salt

React 1-naphthol-2,4,7-trisulfonic acid, or 1-naphthol-4,7-disulfonic acid, or 1-naphthol-2,7-disulfonic acid, or more usually the nitroso-compound of the latter with nitric acid

Naphthol Yellow RS (By) was 2,4-dinitro-1-naphthol-8-sulfonic acid *GP* 40571 (*Fr.* **1**, 393)

Caro, *GP* 10785 (*Fr.* 1, 118)
Badische Co., *BP* 5305/79; *USP* 225108; *FP* 134632
Seltzer, *GP* 20716 (*Fr.* **1**, 330)
Levinstein Ltd., *BP* 5692/82; *USP* 289543
Leonhardt Co., *BP* 11318/87
FIAT 764 — Naphtholgelb S
Graebe, *Ber.* **18** (1885), 1126
Knecht & Hibbert, *Ber.* **37** (1904), 2475; *JSDC*, **20** (1904), 249
Morgan & King, *JCS*, **121** (1922), 1728
King, *JCS*, **125** (1924), 1334

Soluble in cold and hot water (yellow) (8% at 0°C)
Slightly soluble in ethanol
H_2SO_4 conc. — greenish yellow; on dilution — weaker and brighter
Aqueous solution + KOH — yellow flocculent ppt.
Aqueous solution + $FeCl_3$ — yellow → yellowish brown

C.I. 10316 Nitro — C.I. Acid Yellow 1

APPLICATION — DYEING

Wool Good exhaustion from a sulphuric acid dyebath
Levelling: good. Suitable for salting

S.D.C. Migration Test { Dyeing method I / Migration 4

Nylon Dyed, to light shades only, from a formic acid dyebath

METHOD
Neutral ... ... ☐
Weak Acid ... ... ☐
Sulphuric Acid ... ■
Chrome in Dyebath ☐

FASTNESS PROPERTIES etc

		A	B	C
ALKALI		4	...	4
CARBONISING		4–5	5	4
CHLORINATION				
Alteration		4	4–5	2
Staining Wool ...			5	
Staining Cotton ...			5	
DECATISING		4–5	5	4
LIGHT ⅓–½ Normal ...		1	1	1
Normal ...		1	1	1
2× Normal ...		1	1	1
MILLING				
Alkaline				
Alteration		1–2	1	1–2
Staining Wool ...			1	
Staining Cotton ...			1	
Acid				
Alteration		...	4	1–2
Staining Wool ...		...	1	
Staining Cotton ...		...	4–5	

		A	B	C
PEROXIDE BLEACHING				
Alteration		1	1	2
Staining Wool ...			5	
Staining Cotton ...			5	
PERSPIRATION				
Alteration		1	3	2–3
Staining Wool ...			1	
Staining Cotton ...			4	
POTTING				
Alteration		5	3–4	2
Staining Wool ...			1	
Staining Cotton ...			5	
SEA WATER				
Alteration		2	1	1–2
Staining Wool ...			1	
Staining Cotton ...			4	
STOVING				
Alteration		4–5	4	3–4
Staining Wool ...			5	
Staining Cotton ...			3	
WASHING				
Alteration		2	1	3
Staining Wool ...			5	
Staining Cotton ...			4–5	

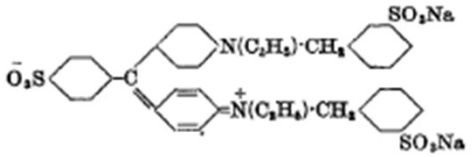
DISCHARGEABILITY Poor
SOLUBILITY Water, good
EFFECT OF METALS Copper, somewhat duller: Iron, much duller

HUE **Bright Greenish Yellow**

ARTIFICIAL LIGHT: slightly redder and brighter

Amacid Yellow S	**AAP**
Calcocid Yellow S	**CCC**
Fouramine S	**Fran**
Java Naphthol Yellow S	**Vond**
Kiton Yellow S	**Ciba**
Nankai Naphthol Yellow S	**KKK**
Naphtocard S	**SAC**
Naphthol Lake Yellow FY	**ICI**
Naphthol Yellow	**ICS**
	MVC, WSS
Naphthol Yellow OS	**Fran**
Naphthol Yellow PL	**FNC**
Naphthol Yellow S	**Acna**
Adel, BASF, CAC, Ciba, DL,	**FDN**
Gy, Ipca, LBH,	**NAC**
NSK, RL, S,	**YDC**
Naphthol Yellow S (*Biological stain and Indicator*)	**NAC**
Naphtol Yellow SF	**RBM**
Naphthol Yellow SNA	**Gy**
Naphthol Yellow SNA	**S**
Naphthol Yellow SS	**Fran**
Naphthol Yellow SXX	**G**
Paper Yellow L	**DuP**
Rakuto Naphthol Yellow S	**KKK**
Solar Yellow NY...	**NSK**
Tertracid Yellow S	**CT**

42095 **C.I. Acid Green 5** (*Green*)
C.I. Food Green 2 (*Bright green*)



Condense benzaldehyde with *N*-ethyl-*N*-phenylbenzylamine, trisulfonate, oxidise the product and convert to the sodium salt

Discoverer — Köhler 1879
FIAT 764 — Saeuregruen kz. F extra stark (see *PB* 74025, fr. 1780–1 and *PB* 74711, fr. 8814)
Mühlhäuser, *Dingl.* **263** (1887), 250, 295
Friedländer, *Ber.* **22** (1889), 588

Very soluble in water (bluish green)
Almost insoluble in ethanol (green)
H_2SO_4 conc. — orange; on dilution — weak yellow
Aqueous solution + NaOH — almost colourless with dull violet ppt.

C.I. 42095 Triphenylmethane — C.I. Acid Green 5

APPLICATION

DYEING

Wool Good exhaustion from a sulphuric acid and Glauber's salt dyebath
Levelling: good

Silk Dyed from an acetic, formic or sulphuric acid dyebath
Levelling: good

Nylon Dyed from a formic acid dyebath

Unions Wool dyed, silk heavily stained, cellulose and acetate unstained

METHOD

Neutral	☐
Weak Acid	☐
Sulphuric Acid ...	■
Chrome in Dyebath	☐

PRINTING

Wool, Silk and Viscose Rayon For direct print styles

FASTNESS PROPERTIES etc

	A	C
ALKALI	1	1–2
CARBONISING	3	4–5
CHLORINATION	...	4
DECATISING	5	4–5
LIGHT ⅓–½ Normal	...	1–2
Normal	2–3	2
2 × Normal	...	2–3

	A	C
MILLING		
Alkaline	1	1
Acid	...	2
PEROXIDE BLEACHING	1	1
PERSPIRATION	2	2–3
SEA WATER	3	2–3
STOVING	2	2
WASHING	1	1–2

DISCHARGEABILITY Moderate to good
SOLUBILITY Water, very good
EFFECT OF METALS Copper, slightly duller: Iron, slightly weaker and duller

TEXTILE USAGE

DYEING

Generally on wool, but of limited interest because of its poor fastness to light and washing
Suitable for bright green shades on silk, the fastness properties being similar to those on wool. Suitable for fugitive tinting of acetate, viscose and silk

PRINTING

Of limited interest for bright greens on wool and silk and on viscose rayon by the urea process

HUE **Green**

ARTIFICIAL LIGHT: little change

Acidal Light Green SF	**MVC**
Acid Brilliant Green SF	**Acna**
Acid Green G	**FDN**
Acid Green GG	**FBy**
Acilan Green SFG	**FBy**
Aizen Light Green SFH	**HCC**
Amacid Green G	**AAP**
Fenazo Green 7G	**G**
Light Green SF	**S**
Light Green SFA	**G**
Light Green SF Yellowish	**FDN**
Light Green SF Yellowish (*Biological stain*)	**NAC**
Lissamine Green SF	**ICI**
Lissamine Lake Green SF	**ICI**
Merantine Green SF	**LBH**
Pencil Green SF	**ICI**
Sulfo Green J	**Fran**
Sumitomo Light Green SF Yellowish	**KKK**

NON-TEXTILE USAGE

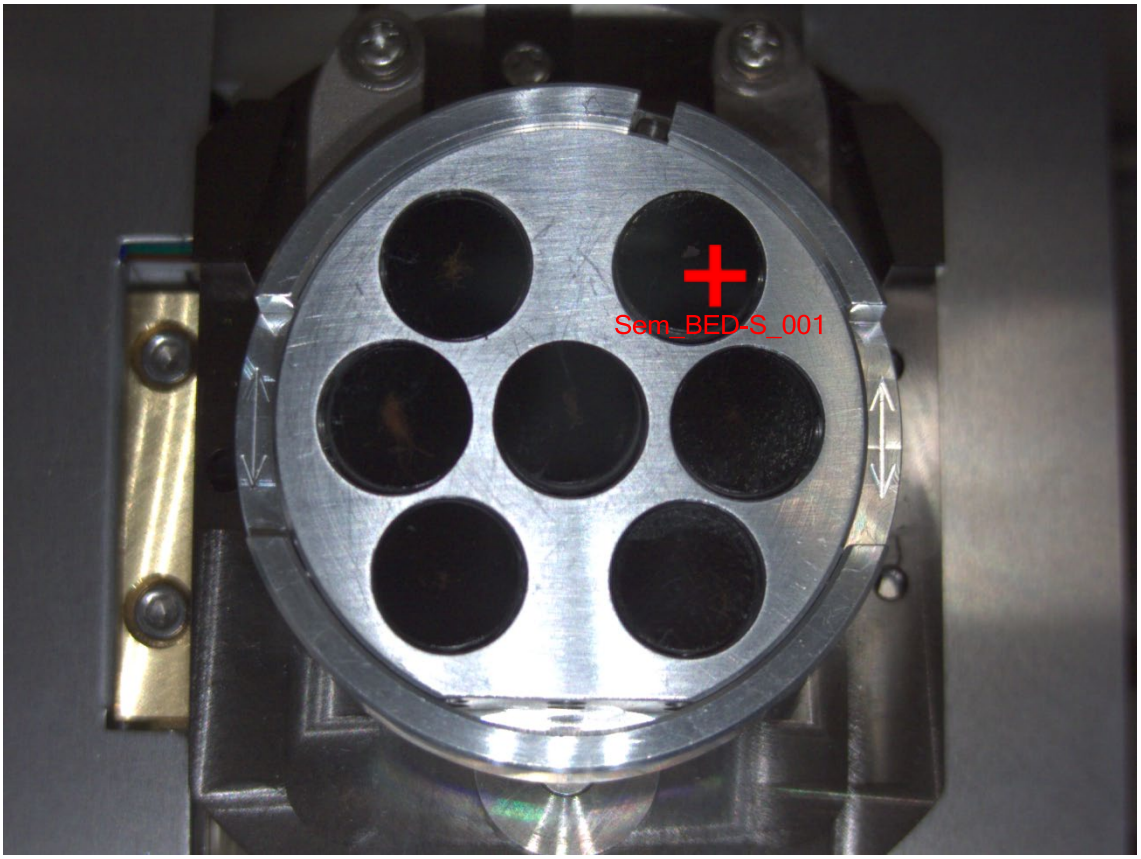
Lakes The barium lake is bright in shade and is of some interest in paper coating and printing inks though the light fastness is poor

Leather On vegetable, chrome and semi-chrome tannages. Properties on chrome tannage (SDC) Light 3, Penetration 3

Paper Of limited interest because of poor light fastness but used occasionally for bright greens

Miscellaneous Suitable for writing inks, copying pencils and spirit lacquers and in purified form for colouring of food, drugs and cosmetics and as a biological stain. See C.I. Food Green 2

2022-122#1 dark purple



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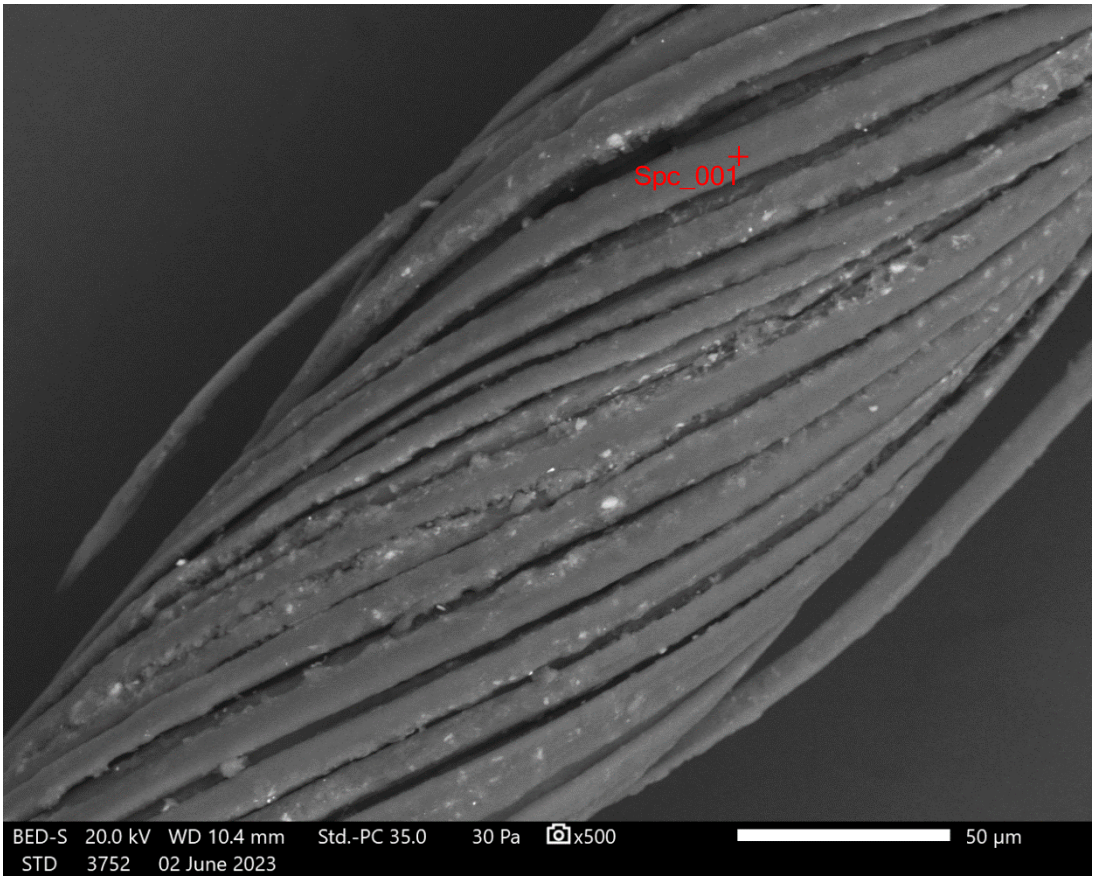
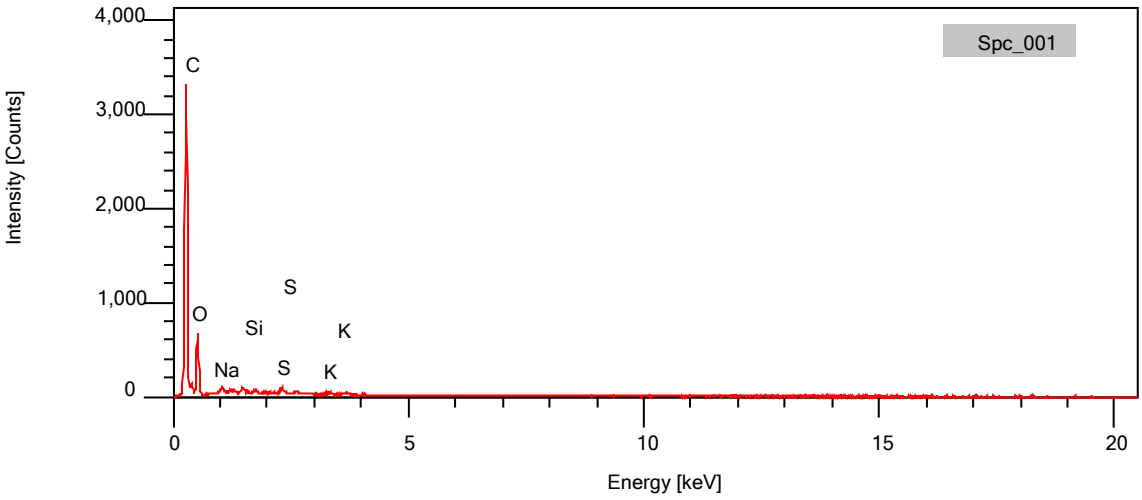

Spc_001
BED-S 20.0 kV WD 10.4 mm Std.-PC 35.0 30 Pa x500 50 µm
STD 3752 02 June 2023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Intensity [Counts]
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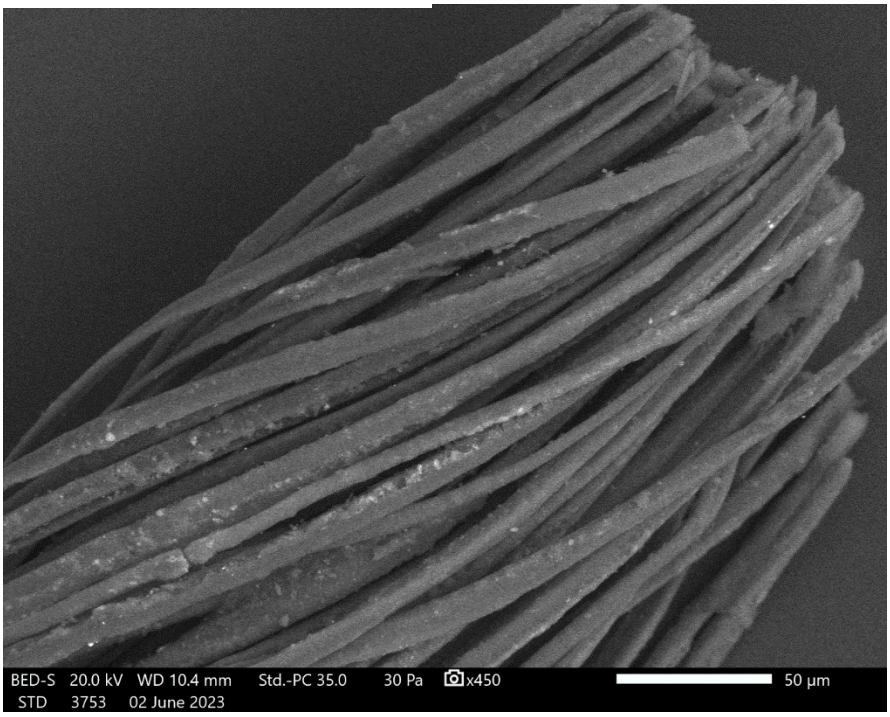
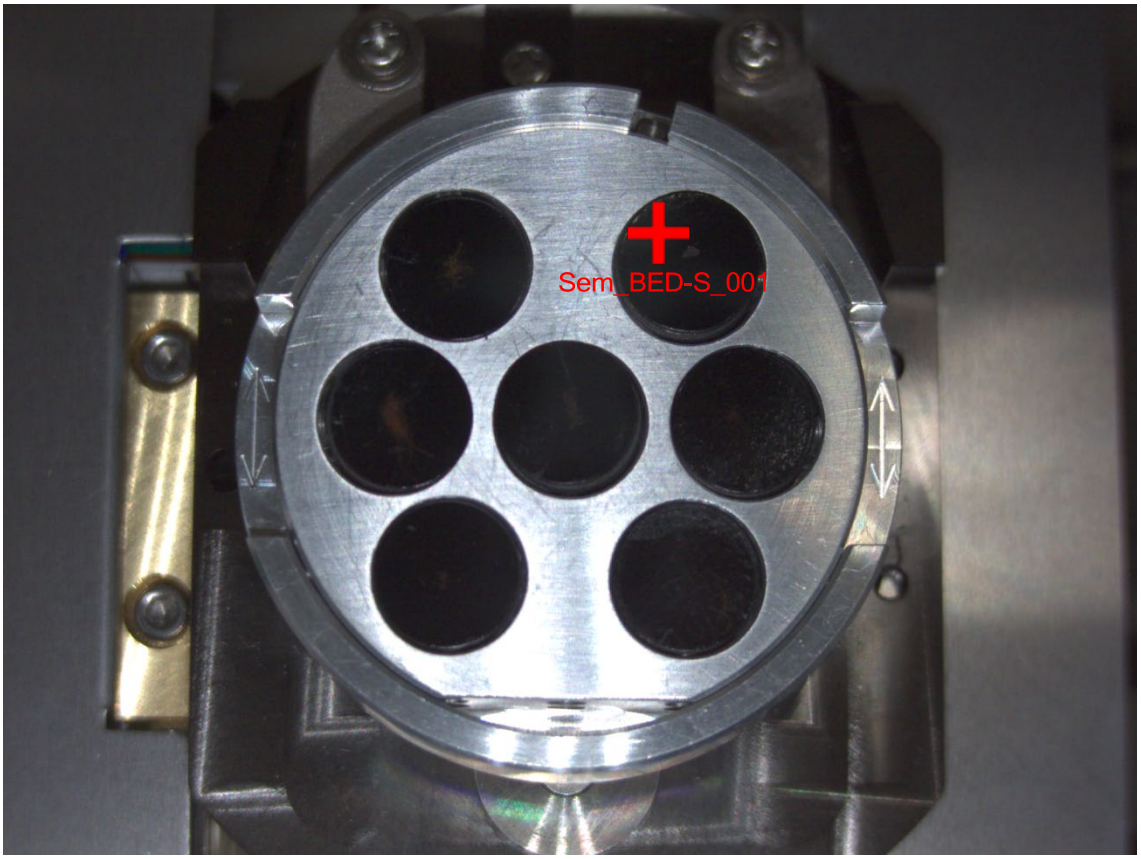
3,000
2,000
1,000
0
C
O
Na
Si
S
S
K
K
0
5
10
15
20
Energy [keV]

Sem_BED-S_002


BED-S 20.0 kV WD 10.4 mm Std.-PC 35.0 30 Pa x450 50 µm
STD 3753 02 June 2023

2022-122#2 red



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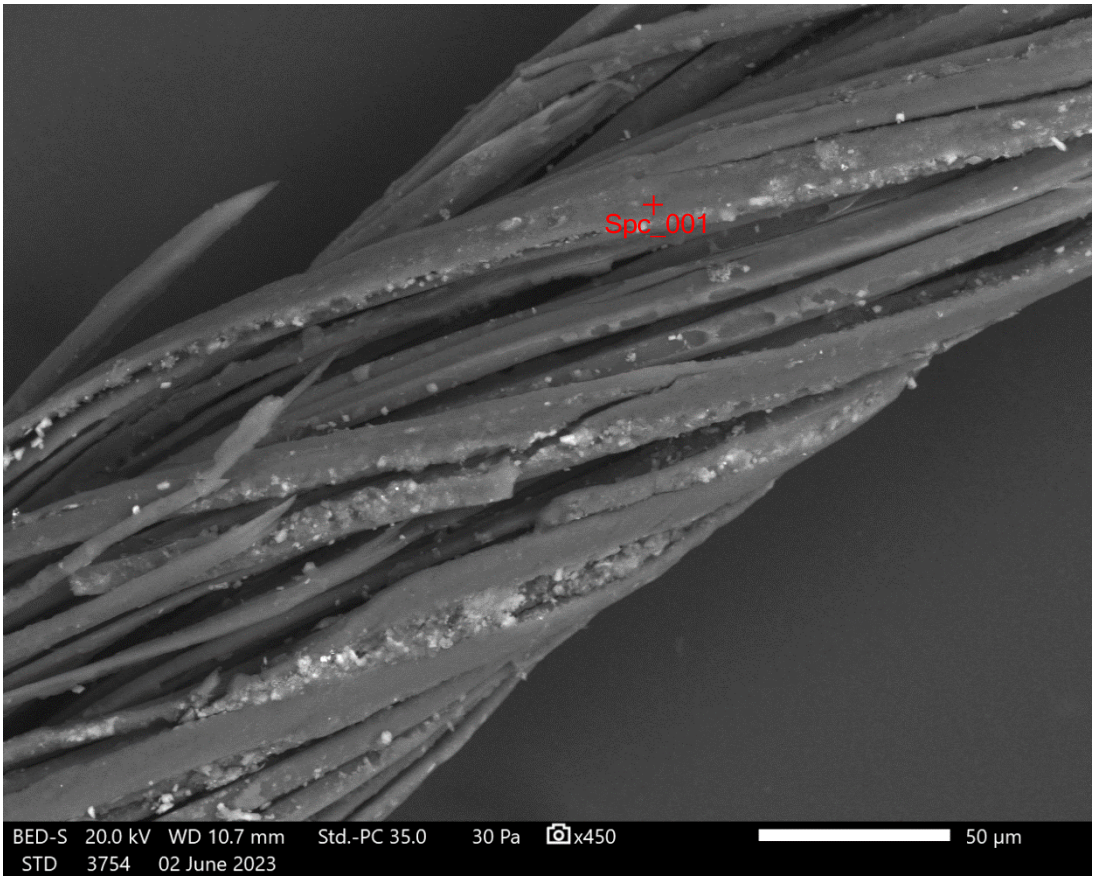
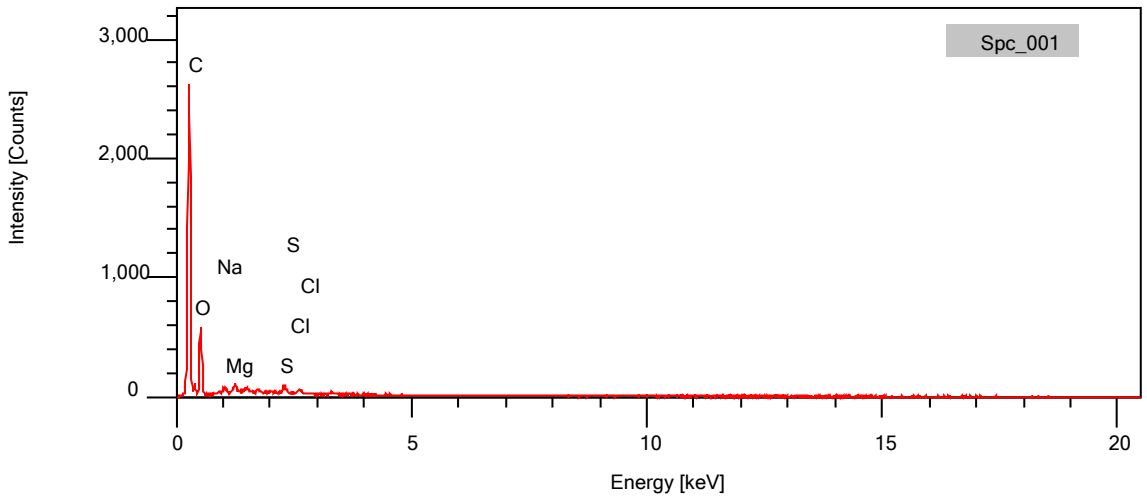
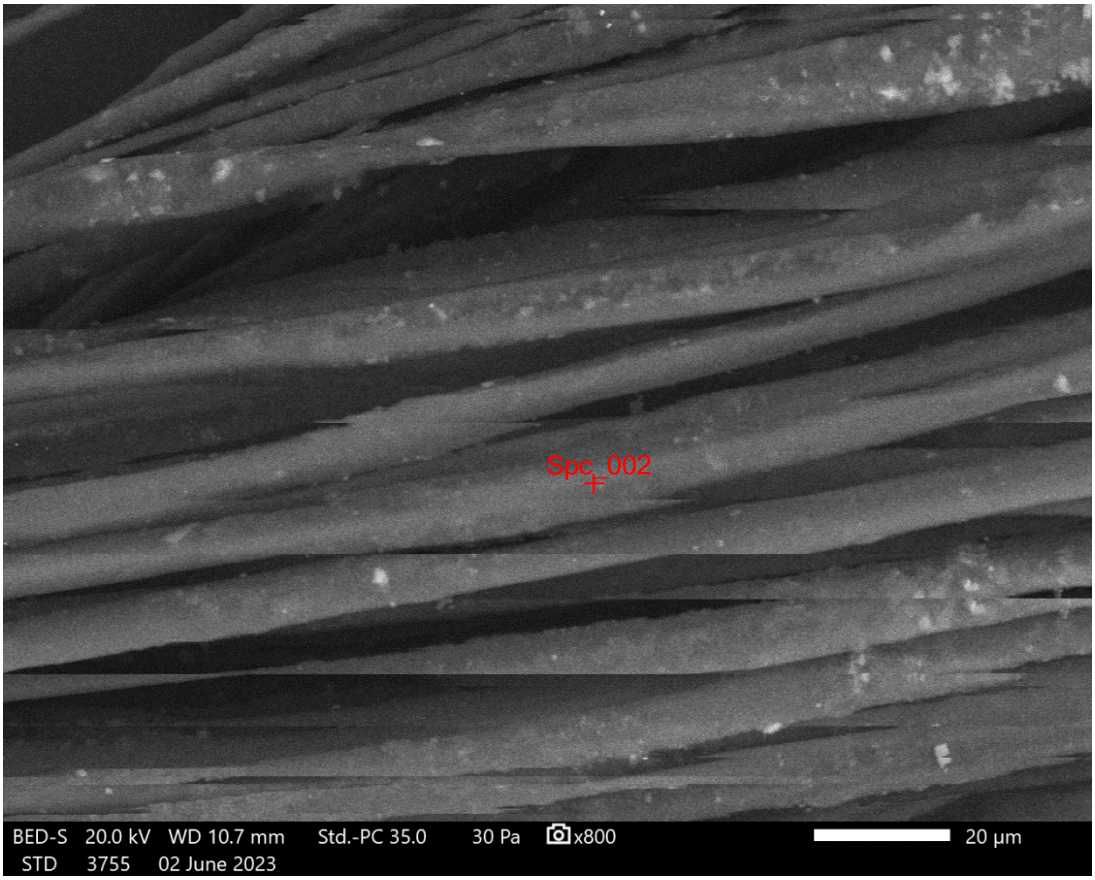
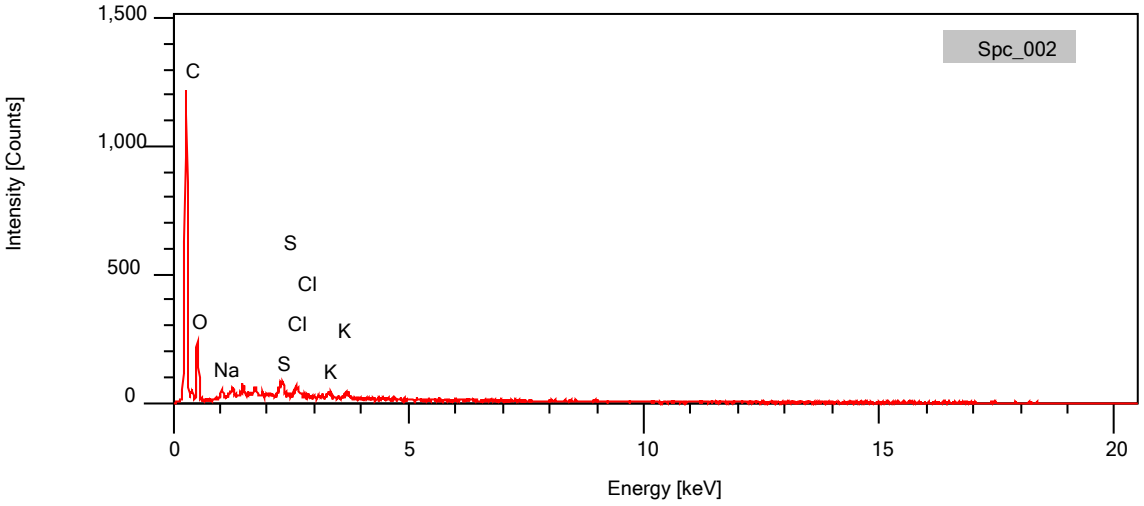

Spc_001
BED-S 20.0 kV WD 10.7 mm Std.-PC 35.0 30 Pa x450 50 µm
STD 3754 02 June 2023

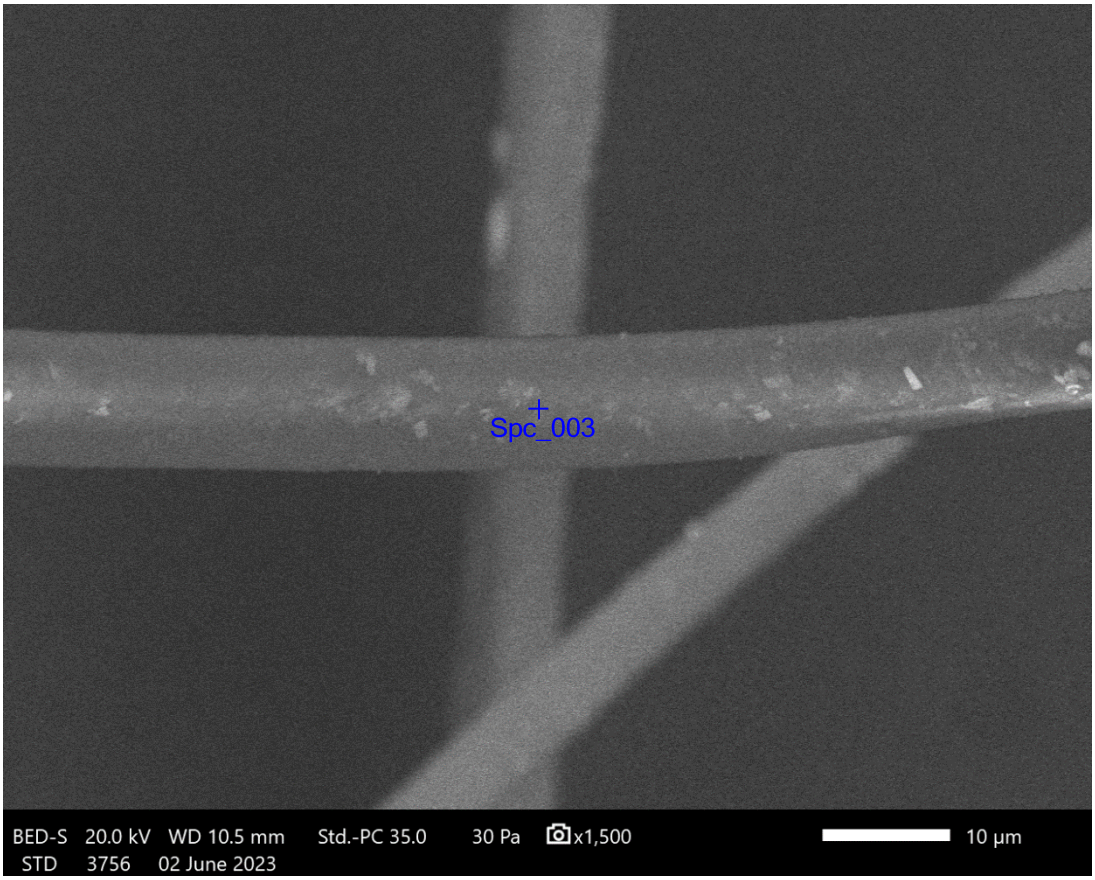

Spc_001
Intensity [Counts]
3,000
2,000
1,000
0
C
O
Na
Mg
S
Cl
S
Cl
0
5
10
15
20
Energy [keV]

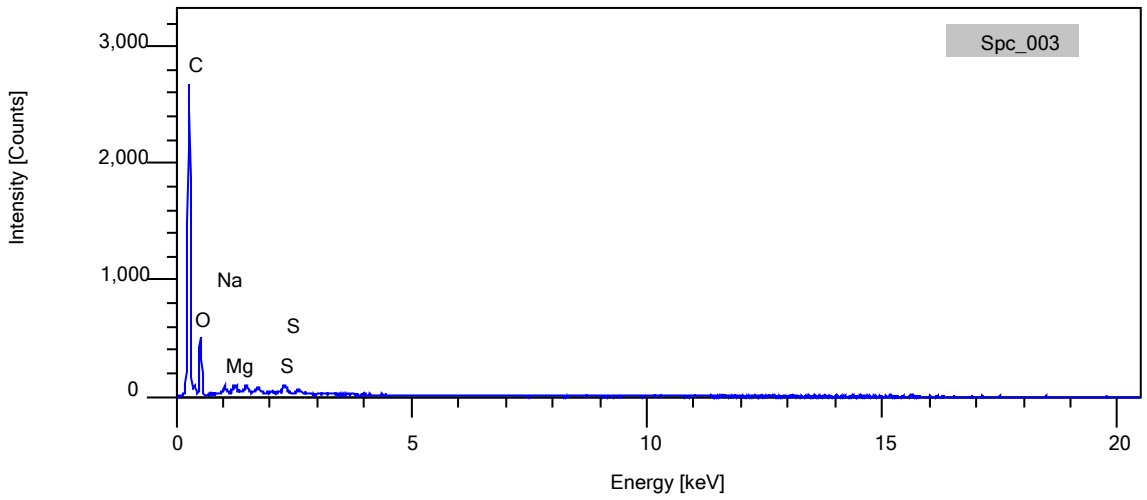
Sem_BED-S_002


Spc_002
BED-S 20.0 kV WD 10.7 mm Std.-PC 35.0 30 Pa x800 20 µm
STD 3755 02 June 2023

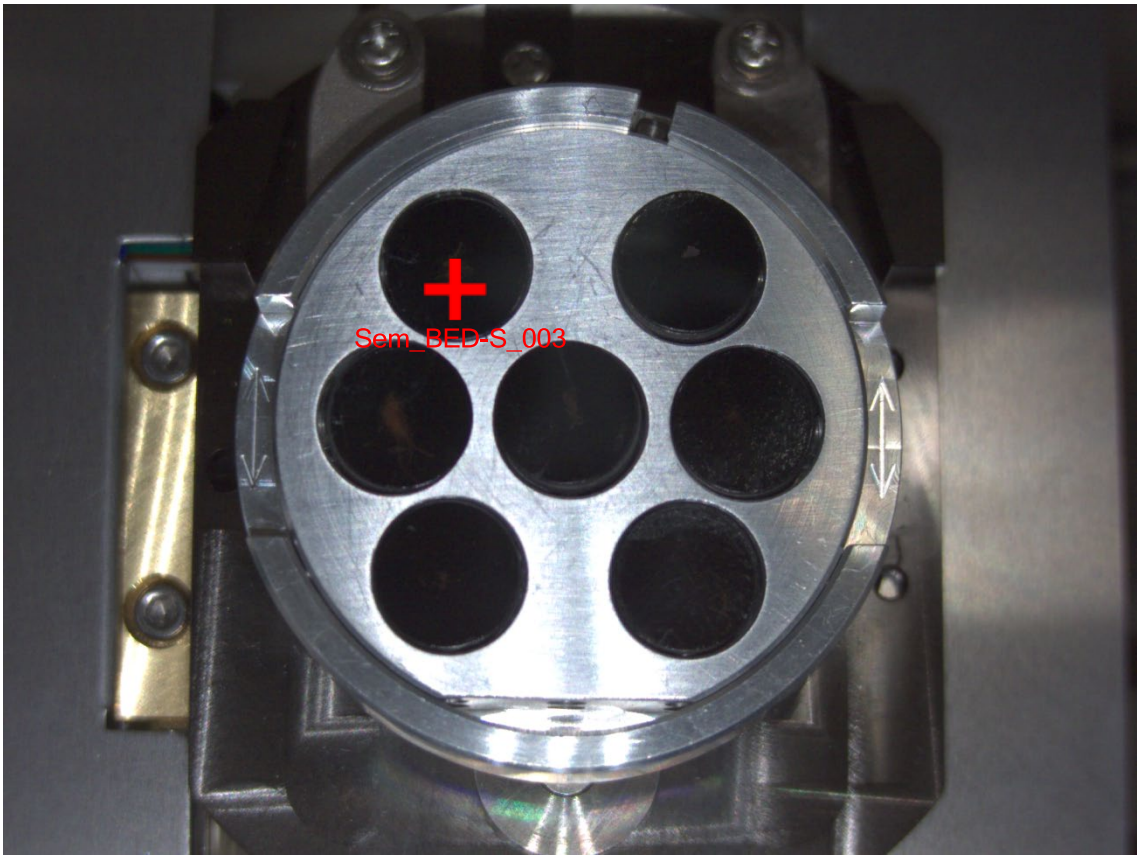

Spc_002
Intensity [Counts]
1,500
1,000
500
0
C
O
Na
S
Cl
Cl
S
K
K
0
5
10
15
20
Energy [keV]

Sem_BED-S_003

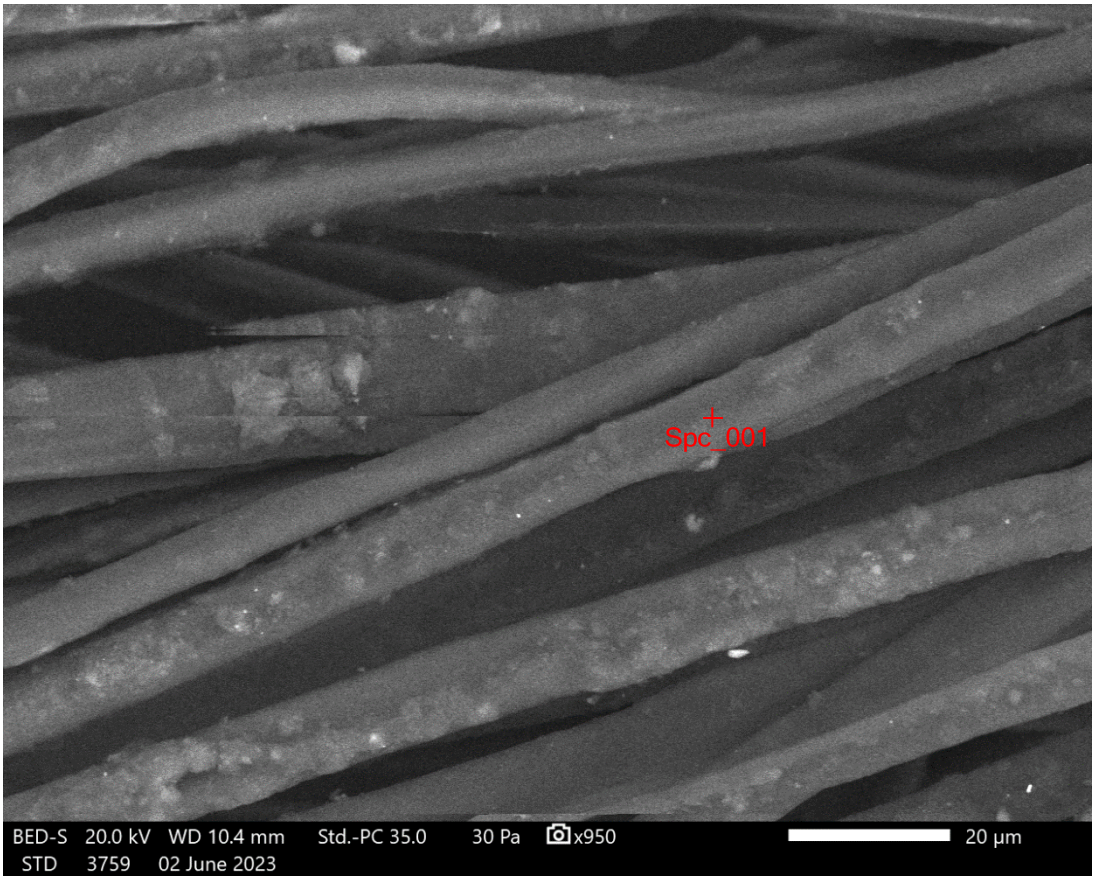

Spc_003
BED-S 20.0 kV WD 10.5 mm Std.-PC 35.0 30 Pa x1,500 10 µm
STD 3756 02 June 2023

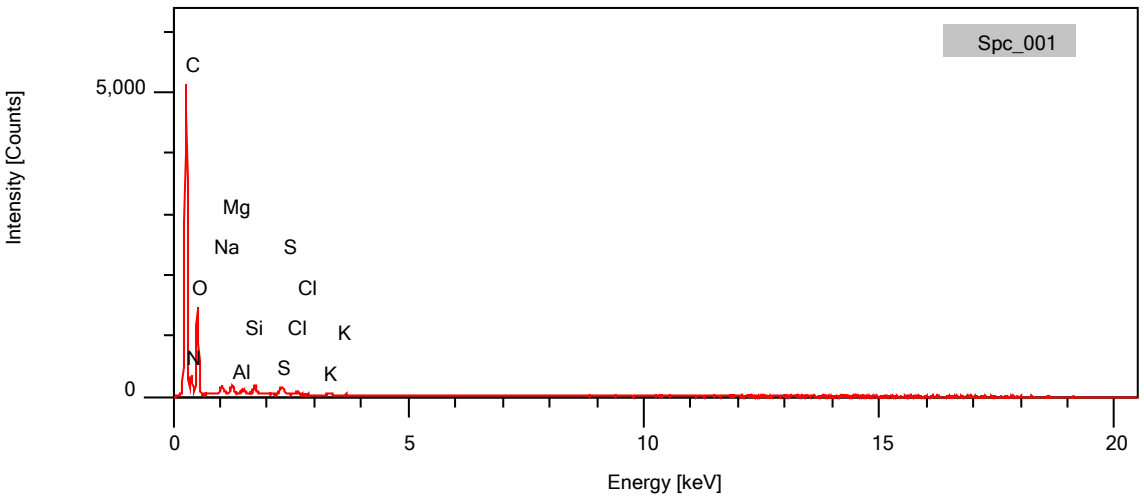

Spc_003
Intensity [Counts]
3,000
2,000
1,000
0
C
O
Na
Mg
S
S
0
5
10
15
20
Energy [keV]

2022-122#3 bright green



Sem_BED-S_003


Spc_001
BED-S 20.0 kV WD 10.4 mm Std.-PC 35.0 30 Pa x950 20 µm
STD 3759 02 June 2023


Spc_001
Intensity [Counts]
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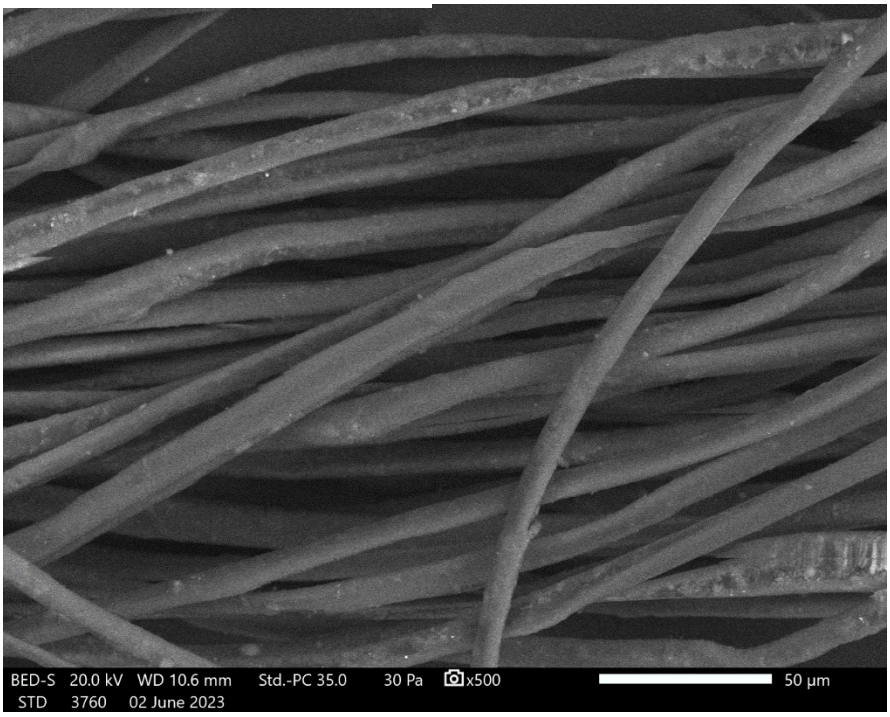
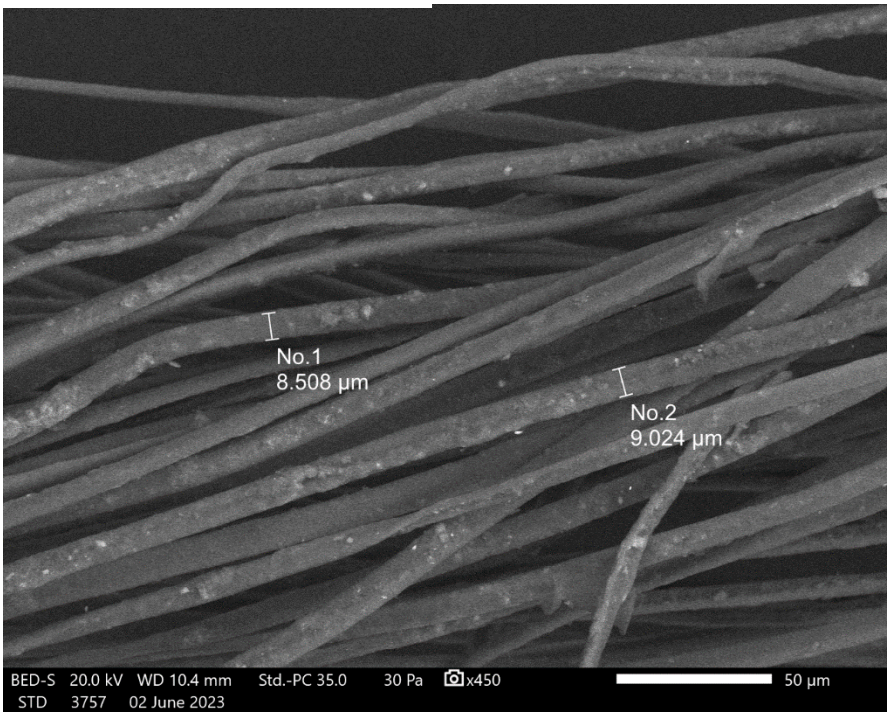
0
C
Mg
Na
S
O
Cl
Si
Cl
K
N
Al
S
K
0
5
10
15
20
Energy [keV]

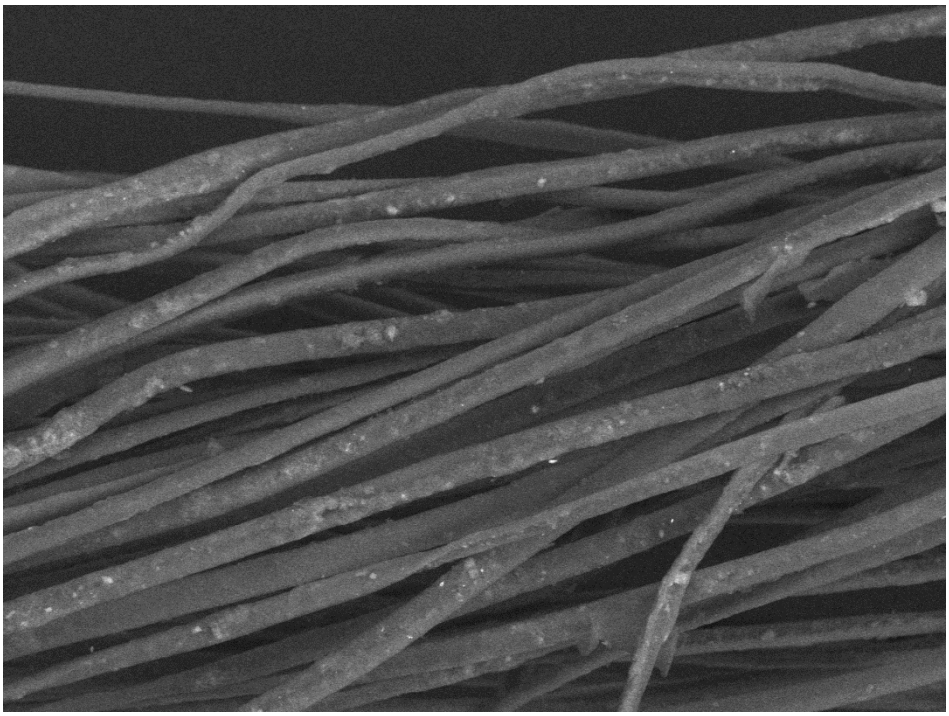
Sem_BED-S_004


BED-S 20.0 kV WD 10.6 mm Std.-PC 35.0 30 Pa x500 50 µm
STD 3760 02 June 2023

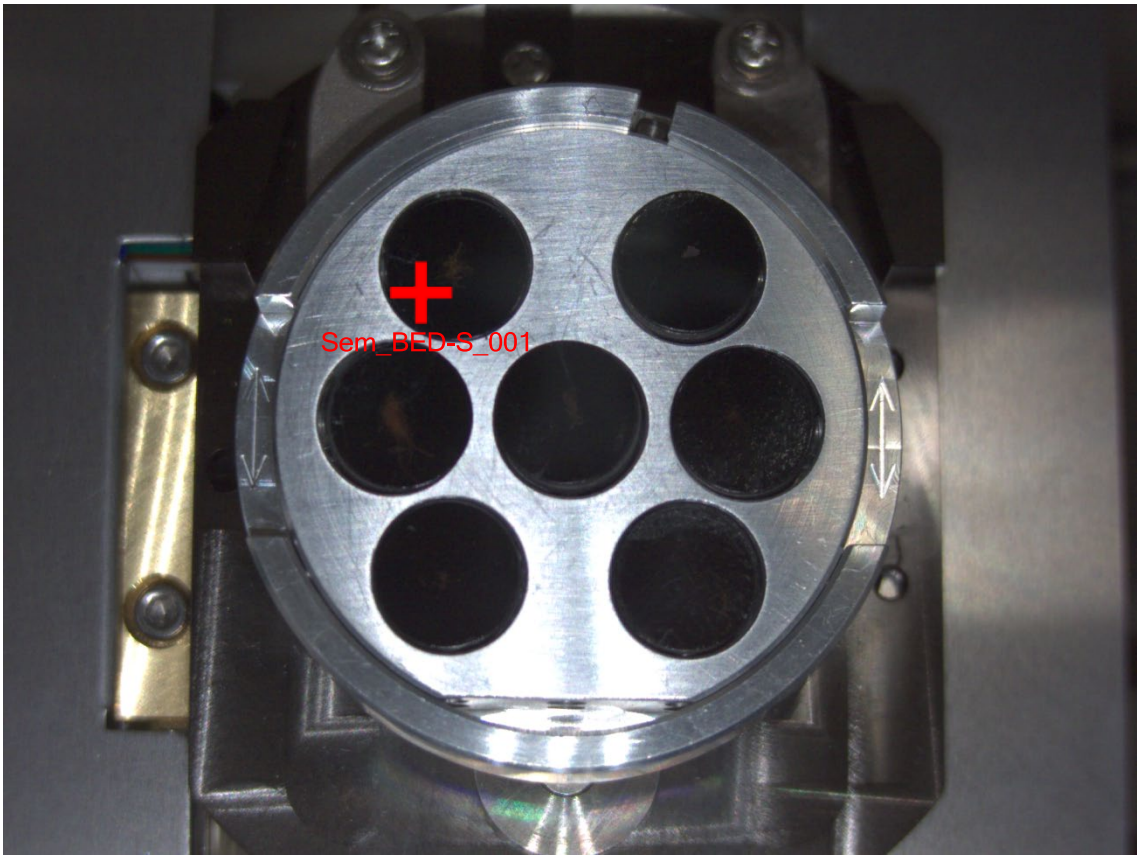
Sem_BED-S_001



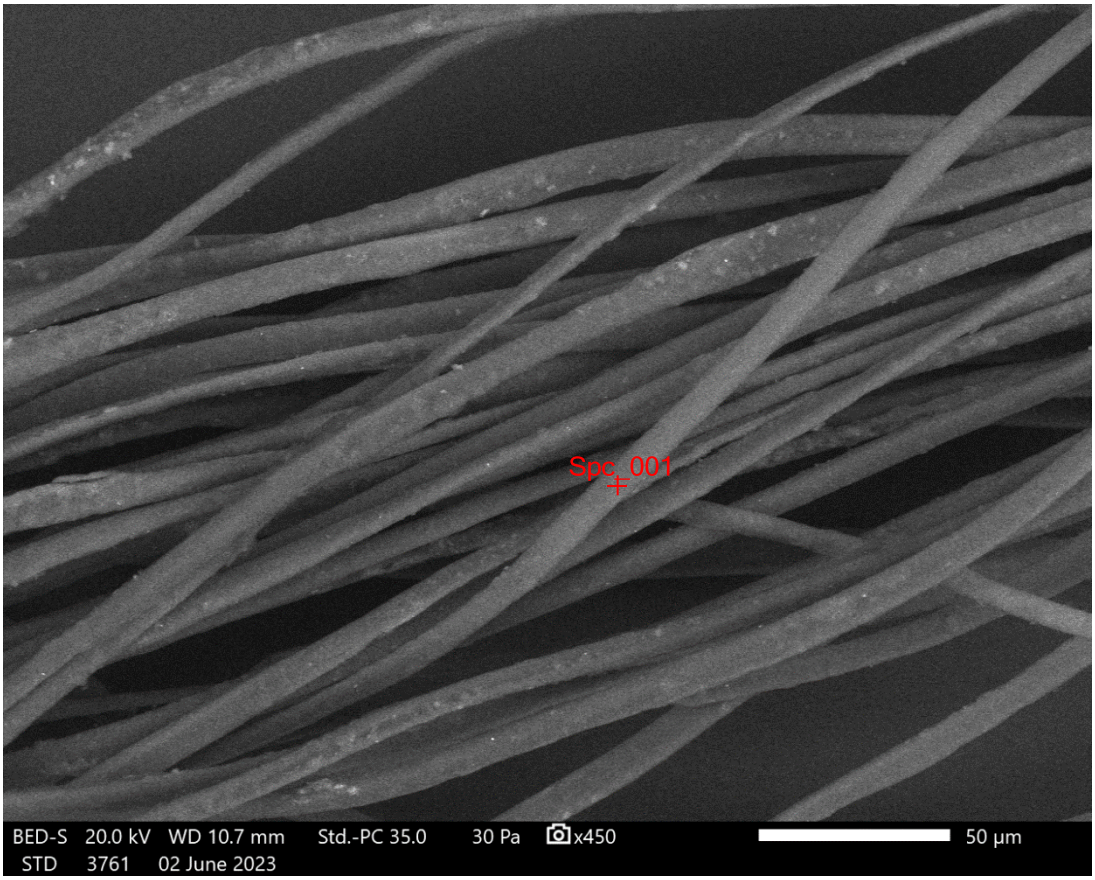
Sem_BED-S_002

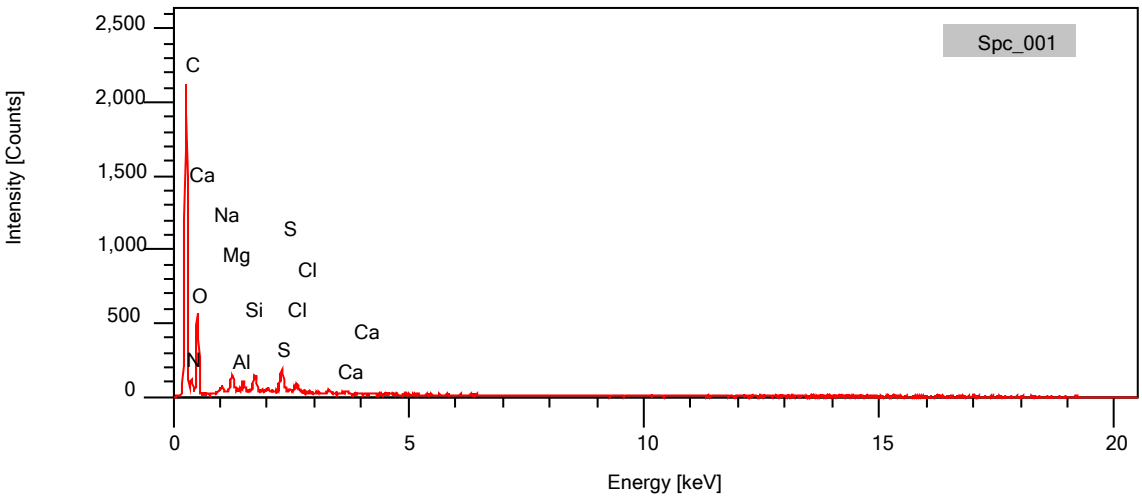


2022-122#4 orange



Sem_BED-S_001


Spc_001
BED-S 20.0 kV WD 10.7 mm Std.-PC 35.0 30 Pa x450 50 µm
STD 3761 02 June 2023


Spc_001
Intensity [Counts]
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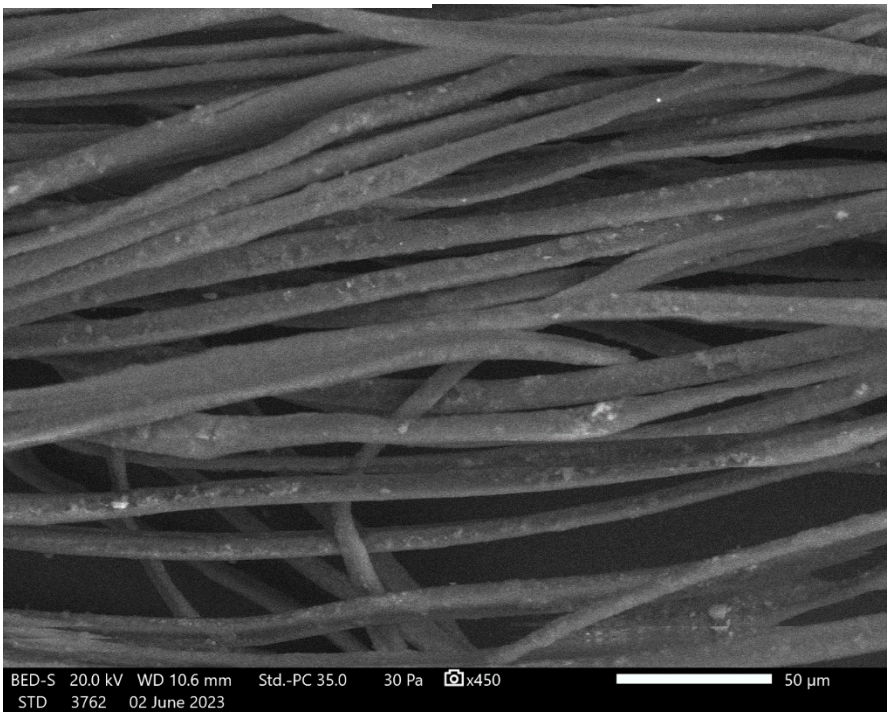
2,000
1,500
1,000
500
0
C
Ca
Na
Mg
O
Si
Al
S
Cl
S
Cl
Ca
Ca
0
5
10
15
20
Energy [keV]

Sem_BED-S_002


BED-S 20.0 kV WD 10.6 mm Std.-PC 35.0 30 Pa x450 50 µm
STD 3762 02 June 2023