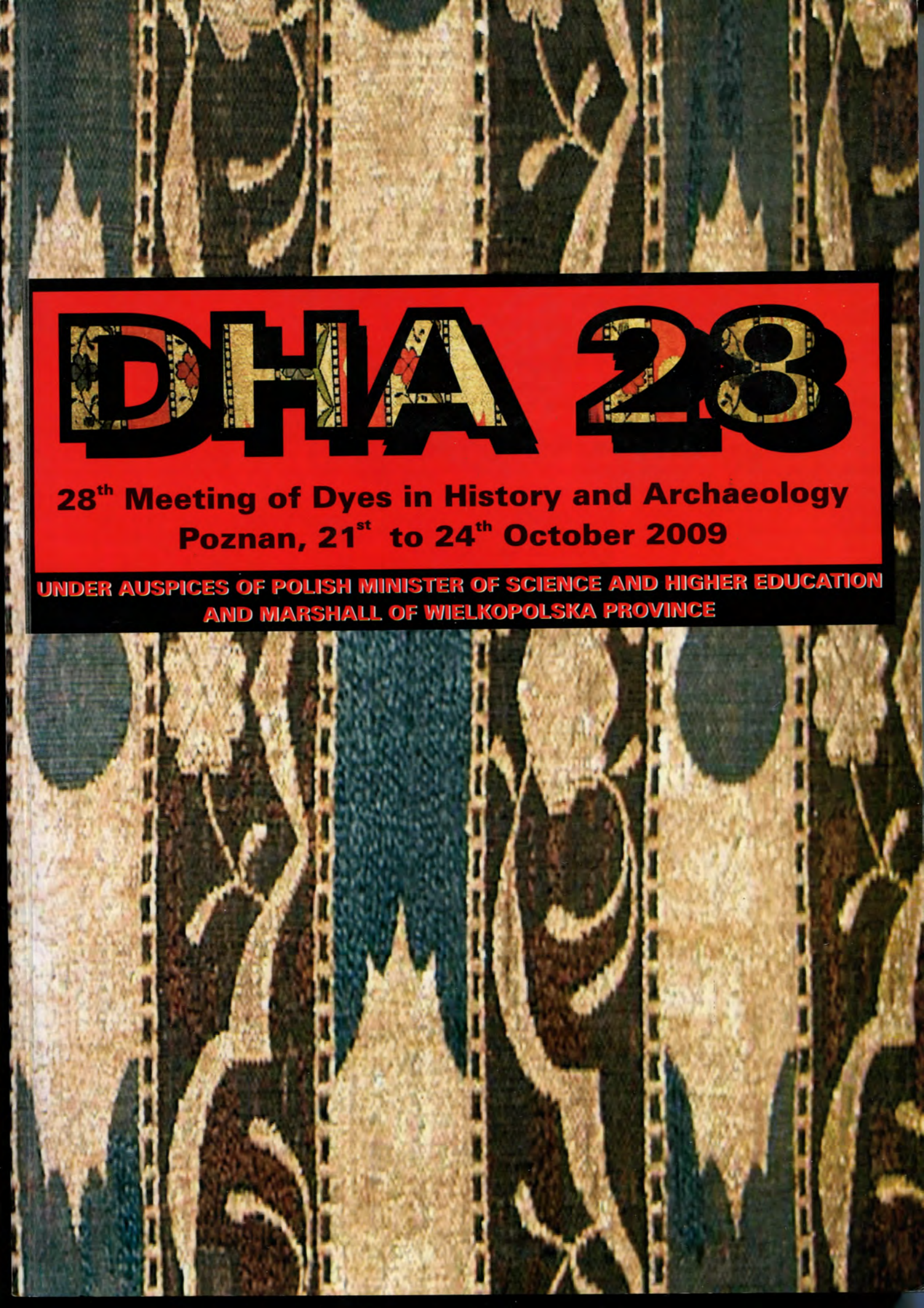

DHA 28

28th Meeting of Dyes in History and Archaeology
Poznan, 21st to 24th October 2009

UNDER AUSPICES OF POLISH MINISTER OF SCIENCE AND HIGHER EDUCATION
AND MARSHALL OF WIELKOPOLSKA PROVINCE

28th Meeting of Dyes in History and Archaeology
Poznań, 21st to 24th October 2009

UNDER AUSPICES OF :

MINISTERSTWO NAUKI
I SZKOLNICTWA WYŻSZEGO

MARSZAŁEK
WOJEWÓDZTWA WIELKOPOLSKIEGO

INSTYTUT WŁÓKIEN NATURALNYCH I ROŚLIN ZIELARSKICH
INSTITUTE OF NATURAL FIBRES & MEDICINAL PLANTS

MUZEUM NARODOWE
W POZNANIU

MUZEUM ARCHIDIECEZJALNE W POZNANIU

Polski Komitet Zielarski

Związek Polskich
Artystów Plastyków
Okręg Poznański

28th Meeting of Dyes in History and Archaeology
Poznań, 21st to 24th October 2009

Conference organizer:
INSTITUTE OF NATURAL FIBRES & MEDICINAL PLANTS

Ul. Wojska Polskiego 71B; 60-630 Poznań, Poland
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The Scientific Committee:

Jo Kirby-Atkinson
Dominik Cardon
Maarten van Bommel
Recep Karadag
Regina Hofmann-de Keijzer
Katarzyna Schmidt-Przewozna

The Honorary Committee:

The Organization Committee:

Grzegorz Spychalski,
Maria Władyka - Przybylak
Katarzyna Schmidt-Przewoźna
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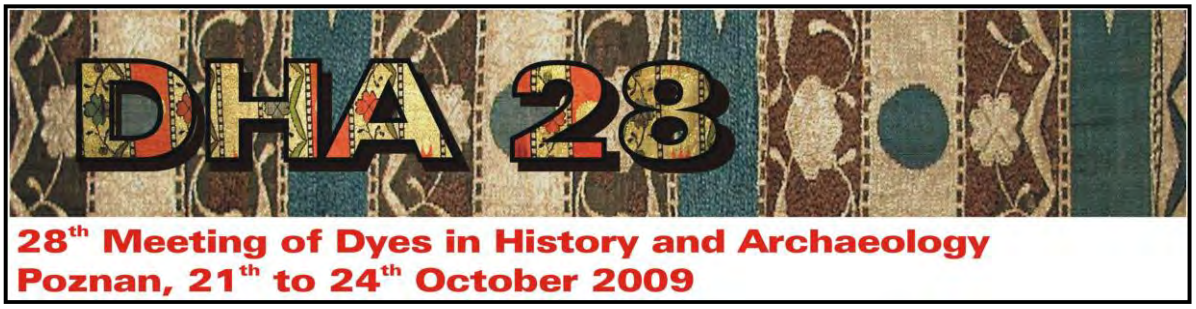
Jorge Barriga - Bedoya
Izabela Maciejowska
Jakub Kowaliński
Małgorzata Muzyczek
Wojciech Polaniak
Anna Grochowina
Agnieszka Modrzejewska

PROGRAMME

BOOK OF ABSTRACTS

Dyes in History and Archeology 28

Including papers presented at the 28th Meeting held at Poznań, Poland, 21st-24th October 2009



DHA28 PROGRAMME

WEDNESDAY, 21st OCTOBER 2009

18.00 – 20.00 REGISTRATION AND INFORMATION : Main entrance of INF&MP

19.00 – 21.00 WELCOME COCKTAIL : INF&MP
Preparing THE POSTERS : Conference Hall – 1st floor INF&MP

THURSDAY, 22nd OCTOBER 2008

08.30 – 10.00 REGISTRATION AND COFFEE : Reception at INF&MP
Preparing THE POSTERS : Conference Hall – 1st floor INF&MP

10.00 – 11.00 WELCOMING SPEECHES : Conference Hall
Director of INF&MP Grzegorz Spychalski
Marshall of Wielkopolska Province
Tribute to John Edmonds by Regina Hofmann-de Keijzer
Tribute to Joseph Doumet by Dominique Cardon

Introduction to the programme: Maarten van Bommel

11.00 – 12.20 SESSION I
Chair: Maarten van Bommel

LC-DAD and LC-MS dye analysis on textiles from Romanian collections	I. Petroviciu, I. Vanden Berghe, I. Cretu, A. Medvedovici, F. Albu
Dyestuff analysis of the 4th–7th- and 13th–14th-century archaeological textiles from the National Museum of History of Azerbaijan	F. Khalilli, B. İbrahimov, T. Yurdun, R. Karadag
The LC-ESI MS Study of Chasubles from the Treasury of the Wawel Cathedral	K. Lech, M. Jarosz
Non-destructive Dye Analysis for the Fragment of Japanese *Kimono*	Y. Sasakı, K. Sasakı

12.20 – 12.40 DISCUSSION session 1

12.40 – 14.00 LUNCH and poster presentation

Opening of the exhibition: More than Polish cochineal *Porphyrophora polonica - traditional natural dyes used in Poland*

14.00 – 15.00 SESSION II
Chair: Dominique Cardon

Analytical challenge and conservation: the case of the earlyrestoration of a medieval tapestry	I. Degano, M.P. Colombini
Tyrian purple and other dyes identified in a Byzantine textile	I. Karapanagiotis, L. Valianou
The Purples of Masada	Z. C. Koren

15.00 – 15.15 DISCUSSION session II

15.15 – 15.45 COFFEE BREAK

15.45 – 17.05 SESSION III
Chair: Regina Hofmann-de Keijzer

True Purple in Ancient Egypt: An affordable luxury	D. Cardon, W. Nowik, M. Trojanowicz, R. Marcinowska, K. Kusyk, H. Granger-Taylor.
Enigma of the Septuagenarian Murex	I. I. Ziderman
Hexaplex snail sex and the Purple pigment	I. Boesken Kanold, Z. C. Koren
The isolation of Shellfish Purple and identification as 6,6′-dibromoindigo by Paul Friedländer (Video).	R. Haubrichs

17.05 – 17.25 DISCUSSION

Closure of the first day

20.00 – 24.00 GALA DINNER: " Brovaria" - Old Market Square

FRIDAY, 23rd OCTOBER 2009

09.00 – 10.20 SESSION IV
Chair: Maria de Melo

An Asian-European Assemblage – Dyestuffs and Mordants on a Viennese Folding Screen, decorated with a Chinese Embroidery	E. Oberhumer, M. R. van Bommel, M. de Keijzer, S. de Groot, R. Erlach, R. Hofmann-de Keijzer
Analysis of Early Synthetic Dyes with HPLC–DAD–MS and FTIR	M. M. Sousa, M. Ballard, J. Giaccai, C. Grzywacz
The colourful life of Adolf Lehne (1856–1930)	M. de Keijzer,R. Hofmann-de Keijzer
Lehne's tables: An overview of 19th-century synthetic dyes	M. van Bommel, M. de Keijzer, K. van Duin

10.20 – 10.35 DISCUSSION session IV

10.35 – 11.00 COFFEE BREAK

11.00 – 12.20 SESSION V
Chair: Recep Karadag

Three medieval tinctorial plants – woad, madder, weld: their usage as medicinal plants since the Neolithic to the present times. The case of woad	B. Verhille
A Leeds Archive Rediscovered and the Orchil Trail to Ecuador	I. Whitworth
Polish cochineal *Porphyophora polonica* L. —traditional natural dyestuff used in Wielkopolska Province.	K. Schmidt-Przewoźna, W. Przewoźny
Is Red Truly the Colour of Love ? Colours' Functions in Polish Folk Attire.	J. Minksztym

12.20 – 12.35 DISCUSSION session V

12.35 – 14:00 LUNCH and poster presentation

14.00 – 15.00 SESSION VI
Chair: Grzegorz Spychalski

A research on wool yarn resistance in Anatolian natural dyeing	M. Akan, Z. Erdoğan
Application of nanolignin for improvement of UV barrier properties of naturally dyed fabrics	M. Zimniewska, J. Batog, K. Schmidt-Przewoźna, E. Bogacz
Dyeing the Silk Texture with Some Colour Plants and Comparing the Light fastness and Breaking Resistance of the Acquired Colours	Z. Tezel, H. Sinem Şanlı

15.00 – 15.15 DISCUSSION session VI

15.15 – 15.45 COFFEE BREAK

15.45 – 17.05 SESSION VII
Chair: Jo Kirby

Striped mittens of the Lady of Eura – a reconstruction of Viking Age nalbinding fragments	K. Vajanto
Dyes and pigment lakes in medieval Portuguese illuminations	M. J. Melo, C. Miguel, V. Risdonne
Surface-Enhanced Raman Spectroscopy (SERS) applied to the detection of organic pigments and dyes in Cultural Heritage objects	C. Domingo, Z. Jurasekova, E. del Puerto, J.V. García-Ramos, S. Sánchez-Cortés
PY-CGC/MS – A new method for analyzing organic dyestuffs	L. Puchinger, F. Sauter, A. Gössl

17.05 – 17.25 DISCUSSION

CLOSING SESSION 17.25 – 17.40

19-21 Visiting National Museum, Poznan

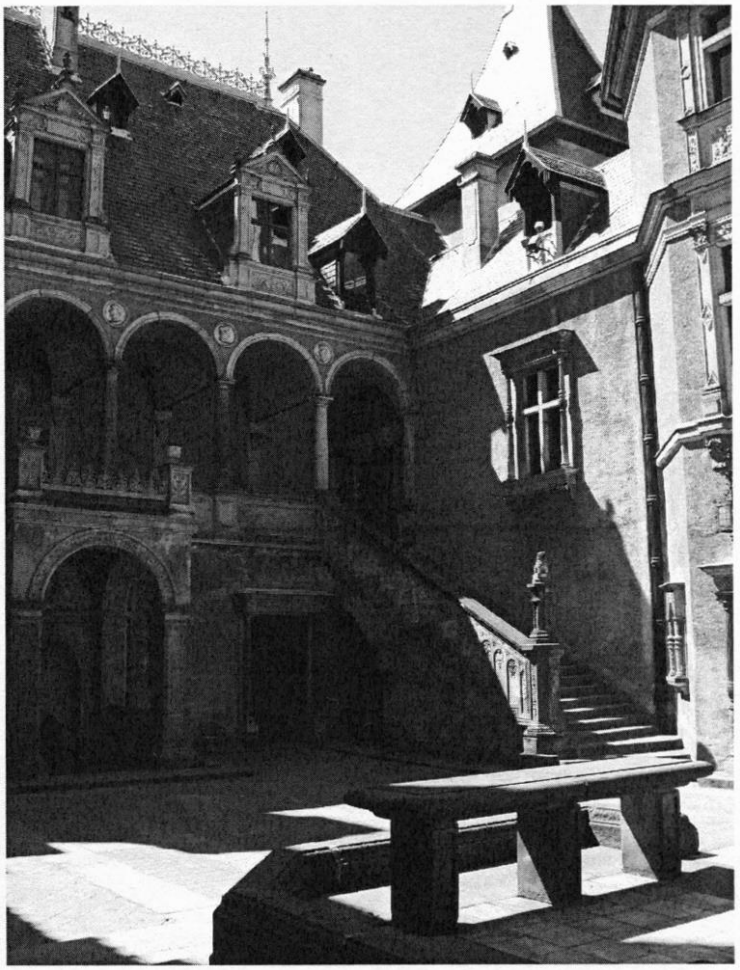
POSTERS

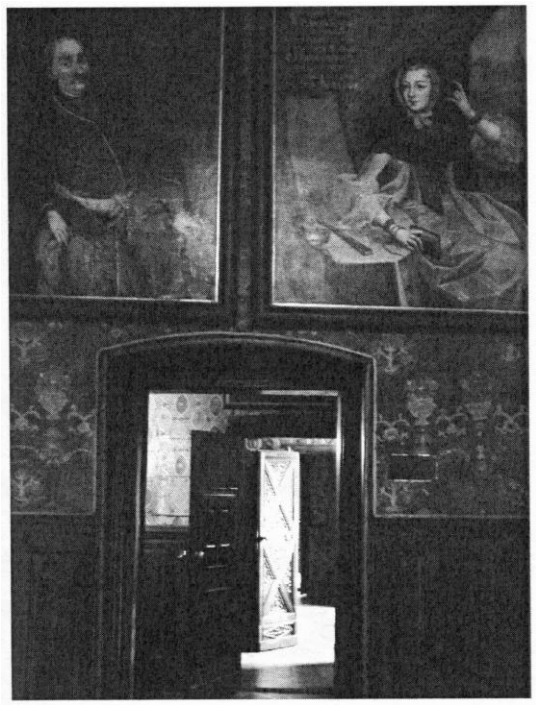
1.	CHARISMA: Cultural Heritage Advanced Research Infrastructures: Synergy for a Multidisciplinary Approach to conservation / restoration CHARISMA: Cultural Heritage Advanced Research Infrastructures: Synergy for a Multidisciplinary Approach to conservation / restoration	M. van Bommel, I. Joosten, A. de Tagle
2.	Dyestuff analysis of the XVIth and XIXth Centuries ethnographic silk textiles from the National Museum of History of Azerbaijan.	G. Abdulova, T. Yurdun, R. Karadag
3.	Problems Raised by the Chromatic Integration in the Restoration of Ethnographic Carpets	I.L. Ilea
4.	Formation, HPLC analysis and colour measurement of the natural pigment obtained from weld (*Reseda luteola*)	R. Karadag, E. Cücen, T. Yurdun
5.	Clothing and Identities. New perspectives on Textiles from the Roman Empire (DressID)	I. Vanden Berghe, M. van Strydonck

6.	Investigation of dyes used in textiles of Mount Athos	D. Mantzouris, I.Karapanagiotis
7.	Carminic acid pigments from Cochineal	E. Dolen, S. Karabulut
8.	Joshua Wardle's "raven blacks" dyed on silk in the mid-1800s.	P.A. Sykas
9.	Characterization of natural dyes from the reference collection of American dyestuff of the Spanish Cultural Heritage Institute (IPCE)	E. Sanz, A. Arteaga, M.A. García, C. Cámara
10.	Traditional Greendyeing in Switzerland. A Retrospective View: Verena Zortea's Life and Work from "Oetzi" to "Cycle of the Year 2008"	Anne Rickenbach
11.	Colour and motif used in felt textures	N. Kayabaşı, N. Ülger, B. Er
12.	Painted pottery of Azerbaijan in the Hellenic period	J. Eminli
13.	Colour and paints used in Kutahya tiles	N. Kayabaşı, B. Er, S.Kara
14.	"Results of Optimisation Studies for Madder Dyeing".	L. Puchinger, F. Sauter, A. Gössl
15.	Natural Resources used by Church Painters in Northern Ethiopia, 2007	J. Mellors, A. Parsons
16.	Dyeing of Silk Yarns with Important Some Dye Plants in Turkey	H. Sinem ŞANLI, N. Kayabaşı, F. Söylemezoğlu
17.	Dyeing, fastness and uv protection properties of natural Dye	R. Mongkholrattanasit, J. Kryštůfek, J. Wiener
18.	Identification of flavonoids in aerial parts of Weld (*Reseda luteola*) extract, dyed silk and colour measurement	T. Yurdun. R. Karadag
19.	The influence of different natural dyes on the degradation of the cellulose textile material	L.Kučerová, M. Škrdlantová
20.	An extensive study of the effect of the enzyme protease that used in textile conservation on cotton fabric dyed with turmeric dye, madder dye.	E. A Harby, N Fragiskos, Kolisis
21.	CHARISMA, Joint research activity: From botanical source to analytical result.	M. van Bommel, M. Groot Wassink, S. de Groot, Art Néss Proano Giabor, J. Kirby, D. Peggie, S. Sotiropoulou, I. Karapanagiotis, C.Miliani, C. Clementi, I.vanden Berghe, H. Stege
22.	TANSY *Tanacetum vulgare* as a source of dye and drug	R. Räisänen, S.Hynninen
23.	Dye plants in phytotherapy	J. Kozlowki., W.Buchwald., A Adamczak, A.Forycka, E. Bilińska
24.	Revitalization of natural dyeing plants in INF&MP plantations.	K.Schmidt-Przewozna, J.Kowaliński, G.Oleszak, Turowski
25.	Ruth Funk Center for Textile Arts	Carla Funk

Saturday, 24th OCTOBER 2009

10.00 – 19.00 Study Tour Wielkopolska Wielkopolska Province
Rogalin Palace, Gołuchow Castle, Museum of Forest, Dinner in Castle Stables, Bisons and Polish horses, Gołuchow Arboretum.





ORAL PRESENTATIONS

LC-DAD and LC-MS dye analysis on textiles from Romanian collections

Irina Petroviciu[1], Ina Vanden Berghe[2] Ileana Cretu[3], ,

Andrei Medvedovici[4,5], Florin Albu[5]

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[2] Royal Institute for Cultural Heritage (KIK/IRPA), ina.vandenberghe@kikirpa.be
[3] National Art Museum of Romania, Bucharest, Romania (MNAR) , adileana@yahoo.com
[4]University Bucharest, Faculty of Chemistry, Cathedra of Analytical Chemistry, Bucharest, Romania (UB) avmedved@yahoo.com
[5]LaborMed Pharma, Bucharest, Romania florin_alburo@yahoo.com

Within a joint research project established between Romanian institutions and KIK/IRPA Brussels, dyes in ethnographic, medieval and archaeologial textiles from Romanian collections were investigated in the last years by LC-DAD. On the other hand, an analytical protocol for natural dyes characterisation and identification by LC-MS was recently established by INCCR and UB, based on the access at modern instrumentation kindly offered by LaborMed Pharma Laboratories, Romania.

The present work presents and discusses the results obtained by useing both analytical techniques in dye analysis on several textiles from Romanian collections, dated 17th-20th c.

Weld (or equivalent), dyer's broom, young fustic, madder, Cochineal, redwood and tannins were the most used biological sources for medieval textiles while synthetic dyes were also detected for 20th c. ethnographic pieces.

The experiments evidenced the advantage of having available both analytical techniques.

DYESTUFF ANALYSIS OF THE IV-VIIth AND XIII-XIVth CENTURIES ARCHAEOLOGICAL TEXTILES FROM THE NATIONAL MUSEUM OF HISTORY OF AZERBAIJAN

F. Khalilli[1], B. İbrahimov[2], T. Yurdun[3] and R. Karadag[4]

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[2] The İnstitute of Archaeology and Ethnography, The National Academy of Sciences of Azerbaijan, 1143, H.Javid 31 – Baku, Azerbaijan
[3]Faculty of Pharmacy, Department of Pharmaceutical Toxicology, Marmara University, 34668 Haydarpasa-Istanbul, Turkey. tyurdun@marmara.edu.tr
[4]Laboratory for Natural Dyes, Faculty of Fine Arts, Marmara University, 34718 Acıbadem-Kadiköy-Istanbul, Turkey. rkaradag@marmara.edu.tr

Reversed-phase HPLC with diode-array detection has been used for identification of historical textiles and dress specimens. The examined objects originate from IV-VIIth, XIII-XIVth and XVIth centuries and belong to the collection from The National Museum of History of Azerbaijan. Extraction from fibres was carried out with HCl/methanol/water (2:1:1) solution. The most important natural red, yellow and blue dyes were found in historical textiles and dresses. In this study, as the main individual chemical components of natural dyes, anthraquinone and flavonoid and indigotin dyestuffs including ellagic acid, alizarin, purpurin, flavonoids and indigotin were identified in the silk, wool and linen historical samples. Indigotin was also identified in the blue and green samples.

The LC-ESI MS Study of Chasubles from the Treasury of the Wawel Cathedral

Katarzyna Lech, Maciej Jarosz*

*Faculty of Chemistry, Warsaw University of Technology, Noakowskiego 3, 00-664 Warsaw, Poland, *mj@ch.pw.edu.pl*

Over 15th and 16th centuries canonicals were sewn mainly from velvet brocades. These richly ornamented fabrics were produced mainly in Italy. In Poland the royal court was their leading customer, hence the Treasury of the Wawel Cathedral holds numerous clothes, and among them liturgical vestments made for special orders in Italy. They have been preserved thanks to their secondary use; a very worn clothes was dismantled and resewn from fragments of textiles apparently similar in style, but of different origins.

Italian textiles in 15th and 16th centuries were dyed with limited number of dyestuffs, consistently used for all batch of fabrics. Information about chemical composition of the used colorants may be important and helpful for identification of origins of examined textile. It is especially promising in case of comparative research.

Most of dyestuffs contain more than one coloring matter, so analytical methods used for their identification must include separation steps. The use of high performance liquid chromatography (HPLC) allows separating many compounds from different organic dyestuff groups: anthraquinones, flavones, anthocyanidines, carotenoids or indigoids. They can be identified with use of spectrophotometric (UV-Vis) or mass spectrometric (MS) detection. Both techniques are useful in dyes analysis, however MS detectors, more sensitive and selective than UV-Vis ones, give also information about structure of each color component.

HPLC–UV-Vis–ESI MS method were developed for analysis of the natural colorants present in fibers taken from several chasubles from the collection of the Wawel Cathedral. Natural preparations used for dyeing analyzed samples were identified in red and violet fibers. The obtained results enabled to compare dyestuffs used in different weaving centers and allowed to verify knowledge of art historians about analyzed textiles.

Non-destructive Dye Analysis for the Fragment of Japanese *Kimono* (KIT Collection AN. 106) at 17C

Yoshiko SASAKI and Ken SASAKI
Kyoto Institute of Technology, Matsugasaki, Sakyo-ku, Kyoto 606-8585 Japan
E-mail; ysasaki@kit.ac.jp

Detailed research on a 17th century traditional textile fragment, “Fragment with Design of Tie-dye Dots (*hitta shibori*) and Embroidered Chrysanthemums, Pines, Bamboo, and Plums” stored in Kyoto Institute of Technology (KIT Collection AN. 106) was carried out by observation of the techniques for dying and embroideries, and by non-destructive spectroscopic methods for dye-stuff analyses. The textile was found separated from “*Koshimaki* Fragment in Black Background Style with Chrysanthemums and Auspicious Motifs in Diagonal Cross Stripes” on a folding screen, one of *Nomura* collection, stored in National Museum of Japanese History (H-35-16), which is believed to have belonged to the empress “*Tofukumon-in*” (1607-1678). Multiple dyestuffs were easily determined by combining with the fluorescence emission and excitation spectra for red bound dots and red embroidery thread. Yellow and purple colored embroidery threads were also characteristic for this textile. The yellow chrysanthemum embroidery on the left side of the fragment was determined to have been achieved by using *Kihada* (Amur cork tree), but the dyestuff used for the faded yellow colors on the right side of the fragment was *Ukon* (Turmeric). Similarly, we discovered by using visible spectra, that the purple was achieved by the use of *shikon* (Gromwell) for right side of the fragment, and that multi-dying of *shikon* (Gromwell) and indigo was used to achieve the color on the left side of the fragment. Thus, it was found that same colors of the embroidery were achieved by using different techniques and materials for different fragments of the textile; they were dyed with different kinds of dyes.

Analytical challenge and conservation: the case of the early restoration of a medieval tapestry

I. Degano, M.P. Colombini

Dipartimento di Chimica e Chimica Industriale, Università di Pisa, via Risorgimento, 35, 56126 Pisa (Italy)

A 15th century tapestry, *L'assalto finale a Gerusalemme*, (dated 1480), Tournai manufacture (Hainaut, Belgium), was studied in the frame of a conservation project in progress at the Opificio delle Pietre Dure (Florence). Violet, red, orange, blue, green and beige areas were sampled in order to characterise the dyeing palette. With regard to black areas, two different kinds of materials were identified by the restorers: very degraded and darker yarns could be distinguished from less degraded and slightly lighter ones. From a careful study of weaving and of the quality of threads, restores hypothesised that the lighter colour was the original one, while the darker one was due to a restoration which took place in the 18th century. Samples belonging to the two classes of blacks were analysed by an optimised LC-MS/MS analytical procedure to validate this hypothesis.

The results highlighted that HPLC-MS technique detected chromophores in the samples extracts at sub-ppm concentrations, thus allowing for identifying all the minor components of extremely complex mixtures of dyes, that could not detected by classical methods such as HPLC-UV-Vis.

The analytical results suggest that the original dye was based on gallo-tannins; yarn dyed by this technique quickly degraded, and during restoration, a different yarn, dyed by superimposing colours, was used.

Tyrian purple and other dyes identified in a Byzantine textile

Ioannis Karapanagiotis* and Lemonia Valianou

Ormylia Foundation, Art Diagnosis Center, Ormylia 63071, Greece

**g.karapanagiotis@artdiagnosis.gr*

The colouring materials applied on Byzantine textiles are to a large extent unknown, as modern physicochemical and analytical techniques have been rarely employed to study these (rare) objects.

In this study fifty microsamples extracted from a Byzantine textile of the 14th century were investigated by HPLC to identify the dyes contained in the important object. The liturgical textile (Epitaphios) was preserved for years in a private collection and was recently donated to the Benaki Museum (Athens, Greece). A variety of different dyes were identified including soluble redwood, madder, kermes, young fustic, weld, indigoid dye source(s) and more important Tyrian purple. The latter was identified in two samples in which the following compounds were detected by HPLC: indigotin, indirubin, 6-bromoindigotin, 6'-bromoindirubin, 6-bromoindirubin, 6,6'-dibromoindigotin, 6,6'-dibromoindirubin. The HPLC profile suggests thus that the source of the purple dye was, most likely, *Hexaplex trunculus* L. *(Murex trunculus)*.

A few samples were extracted from areas of the object, where later interventions were performed. It is noteworthy that cochineal, which is not included in the results collected for the samples of the original Byzantine textile, was detected in these samples, along with madder, weld and an indigoid dye source.

THE PURPLES OF MASADA

Zvi C. Koren

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The tragic 2,000-year old story of the Judean Desert archaeological site known as Masada – "fortress" in Hebrew – is well known from the writings of the 1st century C.E. Jewish-Roman historian Josephus Flavius. In that recount, the last vestiges of rebels fighting against the Roman occupation of Judea took refuge atop the fortified palace built about a century before by King Herod. When the Roman army was besieging the rebels' fortified positions and the final assault was imminent, according to Josephus, almost a thousand rebels and their families committed mass-suicide rather than being taken captive by the Romans. This powerful action, the fantastic palace remnants, and Masada's last stand against Rome has catapulted this site to be one of the most important in ancient Israel. Consequently, artifacts discovered from that site have not only historical and archaeological significance, but also convey personal and emotional ties to that time in history.

Textiles are one of the most personal of artifacts associated with the people who used them, and certainly the Masada artifacts are no exception. This talk will highlight the latest research and discoveries pertaining to the dyes utilized in the Masada textiles, especially the purple dyeings. Masada presents a classic case study of the methods in which the ancients of the Roman Period produced purple-dyed textiles. These Masada examples include the so-called "fake" or the "poor-people's plant purple" produced from the red madder dyestuff and indigotin from woad. Another combination with woad was the use of the red-dye from Kermes vermilio insects. Finally, prestigious purple Masada textiles were also produced from Muricidae snails, specifically *Hexaplex* (also *Murex*) *trunculus* species. These textiles include the Royal (or Tyrian) Purple referred to in the Bible as *Argaman* ("Priestly Purple") as well as the discovery, for the first time, of the first biblical *Tekhelet* ("Venerated Violet") from ancient Israel. The dyes were analyzed via the HPLC-PDA technique.

TRUE PURPLE IN ANCIENT EGYPT : AN AFFORDABLE LUXURY

Cardon D.[1], Nowik W.[2], Trojanowicz M.[3], Marcinowska R.[3], Kusyk K.[3], & Granger-Taylor H.[4]

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[3]Faculty of Chemistry, Warsaw University, Pasteura 1, 02-093 Warsaw, Poland. E-mail: trojan@chem.uw.edu.pl.

[4] 22, Park Village East, London NW1 7PZ, United-Kingdom. E-mail: hero@granger-taylor.com.

An international research programme on the characterization of the indigoid compounds from purple-producing Muricidae species in objects of cultural heritage, in which the five first authors participated, resulted in improved analytical methods[1]. These were applied for a series of dye analyses of archaeological textiles discovered in the rubbish dump and the fort at Didymoi, one of the *praesidia* along the caravan road from Koptos to Berenike in the Eastern desert of Egypt. True mollusc purple was identified in 10 fragments of clothes. It was used both as unique source of colorant or in combination with red dyes (kermes or madder). The presentation discusses the possible provenances of these textiles, the social significance of such discoveries in the rubbish dumps of *praesidia* and the possible reasons for using purple in combination with red dyes.

The hypotheses discussed will include the following points:

- from a social point of view, wearing clothes adorned with true purple dye was probably more accessible to middle and lower classes than it had been thought so far on account of the small number of identifications of mollusc purple in archaeological textiles.

This appears to have been allowed by such practices as: using purple mostly for the comparatively small tapestry ornaments of tunics and mantles; using up purple vats until exhaustion; diluting purple (the “conchylian colours” mentioned by Plinius); recycling worn clothing.

- the frequent light-pinkish and mauve to dark violet or burgundy colours represented in the clothing of the contemporary mummy portraits from Egypt were meant to represent the true mollusc purple identified on similar archaeological fragments of clothes. This

[1] Program PHC “Polonium” n° 13848QC supported by the French and Polish Ministries of Research.

confirms the fascination for this dye, explicit in the abundant literature on purple in Mediterranean antiquity and especially in the papyri and ostraca from Roman Egypt.

- from a technical point of view:

letting aside the fascinating field of imitation purples, on which much has been contributed by our former studies of dyes in the textiles from the *praesidia*, this series of identifications tends to confirm that in Roman Egypt, the most sought-after shade of purple was a reddish purple close to the prestigious colour of “Tyrian purple”. There obviously existed different purple-dyeing centres and/or dyeing processes. Some dyeing centres may – permanently or seasonally – only have had access to indigo-rich/dibromoindigo-poor mollusc species, or may have used dyeing processes that resulted in indigo-rich/dibromoindigo-poor dyes. Hence the practice of top-dyeing with red mordant dyes?

ENIGMA OF THE SEVENTY-YEAR-OLD MUREX

Irving I. Ziderman

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Purple dyes from Mediterranean murex shellfish were among the most precious treasures of antiquity. There were two types: Tyrian purple (biblical *argaman*) was made from spiny dye-murex (*Bolinus brandaris*), often in admixture with rockshell (*Stramonita haemastoma*); chemically, it is 6,6'-dibromoindigotin. Hyacinth purple (biblical *tekhelet*) had a bluer shade than Tyrian purple, giving a violet, and was made from banded dye-murex (*Hexaplex trunculus*); it is a mixture of dyestuffs, largely monobromoindigo (MBI) and indigotin.

Amongst the characteristics specified in the Talmud for recognizing the shellfish (Hebrew *hilazon*) used for dyeing *tekhelet*, one of the four points listed there has hitherto escaped satisfactory elucidation: it is - 'ascends (or goes up) once in seventy years' (*Menahot* 44a). A literal meaning would imply a life-cycle lasting seventy years: but the Talmud does not state the year from which to reckon the anniversary! In fact, such longevity is unknown in the mollusk world, including *H. trunculus*. Moreover, there is no historical indication of this periodicity in regard to the ancient hyacinth-purple-dyeing craft. Indeed, it is implausible that, throughout its 3,000-year-long history, such a widespread manufacturing industry was dependant on supply of its essential raw material becoming available just once in seventy years.

Therefore previous authors were constrained to regard the Talmudic enigma as hyperbole, indicating that the creatures merely reappeared intermittently: so 'once in seventy years' may perhaps be just a metaphoric allusion to the renowned infrequency of Halley's comet. Accordingly Herzog (1913) rejected *H. trunculus* as the source of ritual *tekhelet* because it appeared to lack such rarity. Some alternative Talmudic texts have 'seven' instead of 'seventy'; consequently Spanier and Ziderman (1982) associated a cycle of seven (months) with the biannual seasons for *H. trunculus* fishing.

Thus it is not surprising that Maimonides' authoritative Code of Judaic law (1178) makes no mention of the enigmatic phrase, even though the other three characteristics from the Talmud are duly recorded there (*Zizith* 2:2). However the Code does add there a novel fourth characteristic of *tekhelet*'s shellfish - '*It is to be found in the Salt (=Mediterranean) Sea*', a phrase hitherto considered to be merely an innovation of Maimonides, it not being taken from the Talmud.

It is now proposed that Maimonides considered the Talmud's '*ascends once in seventy years*' to mean that the murex never ascends out of the sea, but is to be found only in the Mediterranean, whence it must necessarily be fished despite the dangers involved.

HEXAPLEX SNAIL SEX AND THE PURPLE PIGMENT

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The most important purple-producing sea snail obtained from the waters of the Mediterranean in antiquity was the *Hexaplex* (also *Murex*) *trunculus*, as experiments have shown that the dye quantity produced from it is by far greater than other such *Muricidae* snails. Previous researchers have attempted to characterize the coloration of this pigment based on certain physical attributes of the snails, but with ambiguous results.

This study examined the gender-specific hue of "purple" pigments produced from the *H. trunculus* species. Snails fished from the waters of southern France were collected and differentiated based on the presence or absence of the prostate gland. This cream- or yellow-colored gland is attached to the hypobranchial gland through a thin dark rectum running between them. Modern environmental pollutants, specifically organotin compounds, used as antifouling agents on ships, have caused the phenomenon known as "imposex" – the imposition of masculine sexual organs, such as a penis and vas deferens in female snails. However, only male snails possess the prostate gland, which is relatively easily discernible when the snail's shell is cracked open. In this way, the sex of the snail can be unambiguously determined.

For the first time, a complete multicomponent analysis of the purple pigment produced from sex-specific *H. trunculus* snails has been performed via the HPLC-PDA method with very important results. Though each gender contains at least 9 different colorants, the most important, and dominant, is the "indigoid triplet", namely, indigo (IND), 6-monobromoindigo (MBI), and 6,6'-dibromoindigo (DBI). The integrated peak area of each of these three dyes was calculated at the standard wavelength of 288 nm from the

respective chromatogram, and expressed as a percentage of total area. It was found that the MBI area in both sexes was close to 50%. In male snails, the purple DBI area was about one and a third greater than that of indigo, yielding a reddish-purple pigment. However, in female snails, the relative magnitudes of the areas were considerably reversed, with the indigo area more than 2.5 times greater than that of purple DBI, giving rise to its bluish-purple hue.

The major application of this study is that we now know how the ancients were able to produce various shades of "purple" – from bluish to reddish, by means of an easily distinguishable physical trait of the snail, the presence or absence of a prostate gland. This study too sheds considerable light, for the first time, on how the biblical violet or bluish-purple woolen dye was produced by selectively utilizing female snails.

The isolation of Shellfish Purple and identification as 6,6'-dibromoindigo by Paul Friedländer.

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Abstract: Exactly 100 years ago the chemist Paul Friedländer, after a laborious extraction of 12'000 *Murex brandaris* purple shells, isolated 1,4 gram of a dark violet dyestuff. With surprise he found about 40% of bromine within this new dye. The first natural organobromine compound was identified.
A colorful video will help to visualize the manner in which Friedländer has proceeded to extract and purified the dye and finally identified the right structure of this fascinating color.

An Asian-European Assemblage - Dyestuffs and Mordants on a Viennese Folding Screen, decorated with a Chinese Embroidery

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A recently finished diploma project deals with the examination and conservation of two large-sized, three-part folding screens.[2] The objects, dating to the middle of the 19th century, were discovered in an attic only recently. Their front side is covered with precious Chinese silk embroidery from the late 18th century, depicting the motif „One Hundred Boys". Archive and literature research and the consultation of a team of experts enable the historical classification of the hitherto unknown objects. Based on careful investigation, the provenance of the embroidery can be clarified and new knowledge concerning Chinese embroidery materials is established. The conservation focuses on the cleaning of a heavily-soiled, water-sensitive embroidered web on one panel and the consolidation of the damaged textiles. An additional challenge is the treatment of the degraded textile hinges of the panels.

The lecture will concentrate on dyestuff and mordant analyses performed on textiles of one folding screen. They date to different epochs and originate from different cultural spheres.

Firstly samples were taken from the Chinese embroidery, made with silk threads of various colours, gold threads and peacock feather threads on black satin. The ground weave shows an unusual deep and intensive colour. But although an iron-mordant was used, the silk is in a stunning good condition. On the other hand, two embroidery threads of beige and light brown hue are highly degraded. This damage probably was not caused by the dyeing process, but by the degumming process of the silk. In both cases, scientific analysis and literature research brought light into the emerging questions. The silken threads of the embroidery are dyed with safflower, berberine yellow and other yellow and red dyes.

In 1847, when the folding screen was made, first a wooden frame was entirely covered with a green cotton cloth. Afterwards a blue silk weave on the reverse side and the Chinese silk embroidery on the front side were mounted.

The dyestuffs and mordants of the green cotton cloth and the blue silk cloth too were analysed. In the green cotton cloth the (semi-)synthetic dye – indigo carmine was analysed. In the blue silk cloth the pigment Prussian blue was identified.

[2] Edith Oberhumer, *One Hundred Boys – One Hundred Problems. The Examination and Conservation of Two Folding Screens Covered with a Chinese Silk Embroidery from the „Sammlungen des Fürsten von und zu Liechtenstein",* unpublished Diploma Thesis, University of Applied Arts Vienna, 2009.

Analysis of Early Synthetic Dyes with HPLC-DAD-MS and FT-IR

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In this work the analysis of early synthetic dyes from the E. Schweppe collection with non-destructive methods as Fourier Transform Infrared Spectra (FTIR) and micro-destructive methods as High Performance Liquid Chromatography with Diode Array Detector coupled to Mass Spectrometry (HPLC-DAD-MS) was performed. The information obtained with both techniques was compared. It will be discussed the safety of the methods (non and micro-destructive analysis) versus “quality” of information (detail of information, etc.). It will be tested the soft extraction methods applied to early synthetic dyes since it is known that for natural dyes some degradation might occur during the extraction method (the early synthetic dyes sometimes can be mixed together with natural dyes). Specific elution gradients for HPLC-DAD-MS analysis of early synthetic dyes were developed.

The results obtained were applied in the analysis of textiles from the XIX century, where the dyes characterization might reveal important contributions to establish the date’s production of the textile as well as for cleaning methodologies.

The colourful life of Adolf Lehne (1856-1930)

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Adolf Lehne was born on the 6th of May 1856 at Winkel am Rhein in Germany. He spent his youth in Mainz where he attended a humanistic grammar school. In 1874 Lehne studied chemistry first at the University of Giessen, later in Berlin, Heidelberg, Freiburg in Breisgau and Munich. In Munich he was a student of Adolf Baeyer and two years later assistant to Jakob Volhard and Emil Fischer.

After his doctor's degree in 1880 he became chemist and later head of the Dyeing and Test Laboratory of BASF in Stuttgart till 1888. In that year he went to Berlin where he started a private Test Laboratory and School for the Textile Industry and at the same time he was an expert witness for the textile industry at the Berlin court of justice.

From 1891 till 1917 Lehne was a member of the Imperial Patent Office in Berlin, in 1893 as a permanent member. In 1901 he became the president of the privy council of the Department IV, responsible for textile-chemical discoveries.

In the autumn of 1889 he founded the dyer's journal 'Die Färberzeitung - Zeitschrift für Färberei, Zeugdruck und den gesamten Farbenverbrauch' published by Julius Springer in Berlin. On the 1st of November 1889 the first edition was published; the journal appeared twice per month.Through the years 'Die Färberzeitung' became highly esteemed and could compete with international journals, such as the Journal of the Society of Dyers and Colourists. In 1920 'Die Färberzeitung' continued as a chemical-technical part of the new textile journal 'Textilberichte über Wissenschaft, Industrie und Handel' (nowadays 'Melliand Textilberichte') founded by Marcel Melliand.

In 1896 Lehne was a member and in 1899 became president of the 'Verein Deutscher Chemiker' in Berlin. In 1908 he was president of the research group for 'Chemie der

Farben- und Textilindustrie' of the 'Verein Deutscher Chemiker'. In 1911 Lehne was also president of the German Colour Fastness Committee. The aim of this committee was to create and establish appropriate test procedures. The members were renowned representatives of the textile and dye industries as well as from universities.

Besides his practical work Lehne wrote some fundamental works on synthetic dyes, such as the 'Tabellarische Übersicht über die künstlichen organischen Farbstoffe und ihre Anwendung in Färberei und Zeugdruck' between 1893-1906. His special interest was the synthetic dye aniline black and together with the chemist Emilio Nölting he wrote the book 'Anilinschwarz und seine Anwendung in Färberei und Zeugdruck' in 1892. In 1908 and 1909 the German version was translated into French and English. The 1926 book 'Färberei und Zeugdruck, Vorschriften gebräuchlichen Farbstoffe und Hilfstoffe' is still a standard work.

From April 1919 till October 1925 Lehne was the ordinary professor and director of the Textile Chemistry Department at the Chemical Technical Institute of the Technical University of Karlsruhe.

Adolf Lehne spent his remaining years in Munich where he died on the 1st of February 1930 of cardiac insufficiency.

Lehne's tables; An overview of 19th century synthetic dyes

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The Netherlands Institute for Cultural Heritage started in 2003 with a project devoted to early synthetic dyes from the period 1856-1900. As in that period hundreds of dyes were developed, we decided to concentrate on a small selection of 65 dyes, covering all dye classes. In this project, both historical and analytical research was done to gain knowledge about the development, use and behaviour of these dyes which are often severely faded. Last year, also a model study to the degradation of Crystal violet was started. The analytical techniques, two HPLC procedures, were very successful. Not less then 85% of the dyestuffs found in samples from objects from that period could be identified. However, we do realize that identification can be complicated if dyes show (under the conditions used) similar chromatographic and absorption behaviour.

Therefore, we decided to study two sample books developed by Dr. Adolf Lehne, dated 1983 and 1899 respectively. The two sample books contain more then 500 samples. More important, information is given about the manufacturer, the dyeing procedure, identification and even results from early ageing tests are presented. These sample books are extremely important as most dyes which were available on the market are represented.

During the presentation, the content and use of these sample books will be discussed. Besides the information given by the books themselves, we also will discuss the analytical results and how they affect the interpretation done so far.

Three medieval tinctorial plants: woad, madder, weld: their usage as medicinal plants since the Neolithic to the present times.

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Through historical research about tinctorial plants, it has become evident that these plants were also known for other usages.
Looking more specifically at the three main European medieval tinctorial plants, we find different usages in different regions and at different times.
The idea of this presentation is to find out, over as long a period as possible, any mentions of medicinal usages of weld, madder and most importantly woad. Manuscripts, followed by printed texts, are interested in descriptions of plants and of their usages for centuries before our era, and a large number of herbals are proposed during our era.
Two main authors are essential in this presentation : Dioscorides and Matthiolus.
Dioscorides compiled the herbal knowledge of antique periods accessible to Greek and Roman authors. Matthiolus, a doctor in the town of Sienna, attempted to present the text of Dioscorides, but he also proposes his own commentaries on this text, thereby giving us an invaluable insight into antique knowledge seen through Renaissance eyes.
From these two authors and their translations into Latin or European languages, we will try to enlarge the time scope to modern and contemporary periods with Culpeper, an English herbalist, and two contemporary French herbalists, Fournier and Caussin. For the period before our era, the most important author is Theophrastus, although Hippocrates is also a source of information.
The evolution of the medicinal usages of tinctorial plants is evident when we compare the proposals made by these different authors.
Among these three plants, woad has a very special position because of the presence of the indol ring, which is the core of the molecules linked to woad usages, in the general life system. Modern biological research is able to explain that the indol itself and different molecules present in the plant or produced by man from this plant are particularly interesting for a wide range of medicinal actions.
During Neolithic times, foraging for woad or indigofera would seem to have been an important activity. It can easily be understood that tinctorial plants were as important as cereals or textile fibre plants because they were used not only as foraging plants but also as medicinal plants during the Neolithic period. The etymologies of isatis (woad) and reseda (weld) in Greek are clearly linked to their medicinal properties and not their

tinctorial properties. However this is not the case of madder (ereuthedanon) which is “giving the red”.

Tinctorial plants need to be cultivated, contrary to medicinal plants which are usually wild. This explains why different forms of the same plant were used either for dyeing or for medicinal purposes.

A Leeds Archive Rediscovered and the Orchil Trail to Ecuador

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This paper will be in two parts. In the first Isabella, a dyer and artist, will describe an archive that recently surfaced in Devon, England. Its owner invited her to view it. Never studied before, it relates to Yorkshire Chemicals, the 200 year-old Leeds-based dye manufacturers, and reflects the changes that took place in the dye industry from the early 1800s to 1940. Realising its unique importance Isabella became committed both to preserving it, and to finding it a suitable home. By the end of 2009 it will return to Leeds where it will be made available for public study.

The second part of the paper will follow the Leeds-based orchil trade. In the process of working through the earlier papers and documents in the archive, Isabella became fascinated by the complex operation of the trade in orchil lichens and began a research project supported by The Worshipful Company of Dyers.

In collaboration with The Royal Botanic Gardens at Kew, Isabella was able to study an 1840s collection of mounted dye-lichen specimens from the Canary Islands that she found in the archive. The knowledge obtained revealed a trading trail from Leeds to Ecuador via London, Liverpool and Tenerife. In autumn 2008 Isabella visited Ecuador to look for the dye-lichen and trace its history more closely, assisted by input from mycologists in Quito and the Galapagos and a maritime historian in Guayaquil.

The ever-increasing demands of mid C19th orchil dyemakers, the history of scientific and botanical research, and pre- and post-colonial South American history all play their part in this paper, based on entirely new material.

Polish cochineal *Porphyophora polonica* L – traditional natural dyestuff used in Wielkopolska Province.

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In the Middle Ages **Polish cochineal *Porophyropora polonica*** was the most famous Polish red dyestuff, which was exported, both to the West and to the East, giving Poland huge profits. The traces of occurrence of this dyestuff in Wielkopolska region date back to the antiquity. The archeological sources mention it when describing the artifacts of the Przeworska Culture in the late La Tene culture (circa 125 B.C. – 35 AD). Thus it is very likely that the larvae of cochineal for dyeing clothes of richer inhabitants of Wielkopolska. However, it is know that only later the *Porophyropora polonica* became widely used i.e. during the period of Pomeranian culture, from which much more relicts have been found.
In the Middle Ages **Polish cochineal** was already the most famous Polish red dyestuff, which was exported bringing Poland huge profits. ***Porophyropora polonica*** was at that tine one of few sources of crimson in Europe. In Polish language the name of both the plant and the parasite attacking its roots has the same name: “czerwiec” – what is also the name of the 6th month of the year and is the linguistic root of the word indicating red colour. In this month the valuable larvae were harvested. The cochineal fields, which abounded with the plant *Sklerantus perenis* L., were guarded to prevent stealing the precious material. Luckily the plant infested with **Polish cochineal** was not demanding in terms of soil requirements – grows on sandy soil, in the mountains and wastelands.
From Mazovia, Wielkopolska, Red Russia the cochineal was sent to Cracow, Wroclaw and Gdansk and farther to textile centers in Upper Germany, Tuscany and Venice. The oldest quote about exporting the cochineal comes from 1412. Later Poznan became the trade centre for cochineal in Poland. In the late 15th century, the most eminent Poznan merchants dealt with the trade and were middlemen between the buyers in Nurnberg and Italian cities and East Poland and Lithuania. Cochineal was a source of high incomes and prestige for the city. Due to outstandingly good organization of the trade and linking between peasants and manor houses and merchants in 1534 the export of this commodity increased to more than 30 tones. Near Poznan, cochineal plantations were run by nuns from Order of Cysterians in Owinska monastery. Since 1242 Owinska, Dziewicza Góra

with neighbouring villages were the property of the monastery and also the place of breeding **Polish cochineal.** The sisters run the breeding until the order was closed in the 18th century and made Owinska a reputed center of dyeing, sewing and embroidering canonical dresses. Importing to Europe of American cochineal undoubtedly led to collapse of the profitable business in Poland. Our cochineal was forgotten and the plant with its once precious inhabitant became useless weed growing on sandy soils. The remains of the history in the Poznan area are antic fabrics from Owinska. Their crimson is the proof of the skills of their producers. And one more trace of the past is the name of one villages between Poznan and Owinska – Czerwonak, coined from „czerwiec" – cochineal.

Is Red Truly the Colour of Love...? Colours' Functions in Polish Folk Attire.

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The use of colours in folk culture generally, and in folk attire in particular, has never been just a matter of an individual preference but rather a part of strictly defined and eagerly observed social code. The code had to be well known by all the members of a given community as its breaking would always evoke rapid negative emotions of the group and would cause severe social punishment. Nowadays, we can find only the last traces of the code in a custom suggesting a bride to wear white and a widow to dress black. Even so modest demands are more and more often not satisfied today without causing any meaningful social reaction.

The paper is based on the author's fieldnotes and archival materials related to Polish folk attire as produced and used at the turn of 19th and 20th centuries. I am interested mainly in these social situations in which the colours of the whole attire or of its specific elements express more than just its visual materiality, namely in which they become a symbol of non-material phenomena or state of minds.

The paper discusses varied, complex and changing in time functions of particular colours as documented by preserved in museums' collections traditional dresses from different regions of Poland and by ethnologists' and folklorists' reports. Patriotic, prestigious and magical functions of colours as well as colours as gender, age and social status indicators will be discussed and explored in more detail.

The importance of the socially approved use or not-use of certain colours in specific social situations was for sure an important factor in adopting new dying techniques and accepting new colour-schemes in Polish villages in the second half of the 19th century (western part of today Poland) and in the first half of the 20th century (eastern regions).

A RESEARCH ON WOOL YARN RESISTANCE IN ANATOLIAN NATURAL DYEING

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As it is known weaving includes production activities which are based on the making use of raw material. In Anatolia, people produce their own wool themselves and dye them with traditional methods. Today, the dyeing of wool yarns with herbal materials is becoming more and more important. Besides, as plant dyeing research has increased, another factor that has gained importance nowadays is wool yarn resistance. Besides the value of purity, wool yarn resistance appears to be another feature in yarn dyeing. Resistance is a factor to be emphasized as it determines the durability of the things to be weaved.

The study aims to determine the resistance values of wool yarns which were dyed by making use of herbs and mordants that are frequently used in traditional Anatolian wool yarn dyeing. In this research, the resistance values of wool yarns will be measured after they are dyed with various plants and mordant which grown in Anatolia and which have an important place in traditional weaving activities. The change in the resistance of dyed wool yarns compared to undyed wool yarns will be determined and some ideas about the effects of the plants and mordant on the wool yarn resistance will be put forward. In the conclusion, some suggestion will be made to contribute to traditional Anatolian wool yarn dyeing methods and weaving fields.

APPLICATION OF NANOLIGNIN FOR IMPROVEMENT OF UV BARRIER PROPERTIES OF NATURALLY DYED FABRICS

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Abstract

The aim of the study was improvement of protection properties of clothes made from naturally dyed linen fabrics against ultraviolet radiation. Ultraviolet rays emitted by the sun are hazardous to human health, can cause erythema, sun allergies, faster skin ageing and skin cancers, especially melanoma, which are caused by damage of the chromosomes in the cells of human body. Therefore, there is a need for efficient body protection against harmful radiation by clothing.

Investigation, which was carried out in INFMP, proved the possibility of excellent synergy of tradition with the newest technological achievements. Process based on traditional method - dyeing with vegetable dyes, can improve UV barrier properties of fabrics. However, the ultraviolet protection factors of the naturally dyed fabrics are not sufficient in extremely sunny days. Application of nanolignin in the process of dyeing with natural dyestuff, results in obtaining a significantly better UV barrier properties of linen fabric, because lignin is excellent natural absorbent of UV rays.

Dyeing the Silk Texture with Some Colour Plants and Comparing the Light fastness and Breaking Resistance of the Acquired Colours

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Silk has preserved its actuality and importance between the textile raw materials with its naturalness, softness, brightness and charm since the first and oldest ages of civilization. It is possible to dye silk textures with vegetable dyes. In this study the following plants which are used in vegetable dying will be used: madder, nutshell, onionskin, and leave of olive tree. With these plants; colouring will be made with the premordant method with 5 different mordant. These will also include non-mordant and mordant (aluminium alum, copper sulfate, iron sulfate, potassium bichromate and sodıum chloride). 4 colouring will be made with the non-mordant method and 20 colouring will be made with the premordant method. A comparative study will be performed in order to determine the colour value, light fastness and breaking resistance of the 24 dyed silk shirting texture.

Striped mittens of the Lady of Eura – a reconstruction of Viking Age nalbinding fragments

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In my presentation I´ll tell about some interesting textile fragments from Eura Luistari, which is a Viking Age cemetery situated at south-western coast of Finland. The fragments are from an inhumation grave, which is exceptional, due to at that time (at the beginning of 11th century) cremation was the most common graving type in Finland.
The textile fragments are from Luistari grave number 56, which belonged to about 40 years old woman. Originally the grave was analyzed year 1969. The largest textile fragments were a base of the "Costume of Eura". In my Master's thesis (2003, University of Helsinki, Department of Archaeology) I analyzed some remaining fragments, which were made using nalbinding technique. I also made a reconstruction suggestion based on them.
There were 6 nalbound textile fragments at the waist of the deceased. The biggest was about 6x9 centimeters. They were connected to a big bronze knife sheath and some finger bones. Because of their placement the fragments were probably from mittens. Nalbound mittens have also been found in some other Iron Age graves.
The nalbound fragments of Luistari were striped: they were made of three distinguish colours – reddish-brownish, blue and light or yellow. Earlier striped nalbound fragments were in Finland thought as socks, but these fragments are clearly from mittens: they have also the beginning of a red thumb.
In my Masters thesis I examined also the thickness of the yarn and the twist. The red and light (or yellow) yarns Sz-twisted ant the blue is finer and thicker, with s-twist. I also analyzed these facts and the colours from some other nalbound fragments (Mikkeli Tuukkala, Halikko Rikala, Perniö Yliskylä, Kaukola Kekomäki). In my presentation I´ll tell more details about these finds.
Based to my analyzes I made a reconstruction suggestion about the Luisteri mittens. I used natural colours to dye the wool yarns: madder to red, heather to yellow and woad to blue. The shape of the mittens is based on Finnish nalbinding tradition.

Dyes and pigment lakes in medieval Portuguese illuminations

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In the past five years, we have undertaken a systematic study of the materials and methods of Portuguese medieval illuminations.

Portuguese codices date from the formation of Portugal as a kingdom and are testimonies to medieval ideas, religion and politics. Color use and production was a consequence of the technology available as well as of cultural and artistic options; defining the specificities of color will contribute to fingerprint the influences of the three different cultures that coexisted in Portugal at that time, Arab, Jewish and Christian. This subject is approached within an interdisciplinary framework, aiming to explore issues related with the symbolic and social meaning of color in medieval Portuguese illuminations, produced during the twelfth and first quarter of the thirteenth century in Portuguese monasteries; namely, in St. Cruz, St. Mamede of Lorvão and St. Maria of Alcobaça.

From the study of all three monasteries' manuscripts, carmine and bottle-green colors emerged as possibly characteristic of the Portuguese production, and the first medieval Portuguese palette is proposed. In the Lorvão manuscripts, namely in the *The book of birds*, the carmine color is based on an organic dye, and infrared analyses indicate that it was possibly obtained from lac dye. The paint is of a beautiful deep red color, displaying a glassy appearance when observed under the microscope.

Historical reconstructions based on *The book on how to make colors* as well as on the experimental evidence gathered will be described. Their importance for a complete identification of the dyes as well as the characterization of the paint recipe used for the color paint production will be discussed.

Surface-Enhanced Raman Spectroscopy (SERS)
applied to the detection of organic pigments and dyes
in Cultural Heritage objects

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Raman micro-spectroscopy has become an extremely useful technique for the non-destructive analysis of inorganic pigments in Cultural Heritage objects. However it can not be routinely applied to the identification of organic pigments and dyes, mainly due to: 1) their enormous fluorescence when illuminated by the laser employed for exciting the Raman spectrum, which hide the Raman bands; and 2) the low sensitivity of the technique, which does not allow their detection in real samples where such compounds are present in minute quantities.

The Surface-enhanced Raman Scattering (SERS) technique can overcome both drawbacks. Thus, when the sample under study is in close proximity of nanostructured metal surfaces, its fluorescence is quenched and its Raman spectrum is enhanced several orders of magnitude. But it has not been till recently that SERS has began to be continuously and effectively applied to the characterization and detection of natural organic pigments and dyes which are employed in Cultural Heritage objects. Our research group has pioneered such application of SERS. Our extensive studies of the SERS spectra of anthraquinones, curcuminoids and flavonoids carried out in the laboratory, together with our recent development of a new method of production of metal nanostructures on real samples (dyed fibers), have allowed us the identification of such compounds in situ, without needing to apply chemical extraction procedures. A thoughtful review of the different approaches adopted till now by different groups for SERS detection of organic pigments, as well as the different proof-of concept experiments developed, will be presented.

PY-CGC/MS – A NEW METHOD FOR ANALYZING ORGANIC DYESTUFFS*

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Up to now the analysis of ancient dyestuffs still found on ancient works of art was carried out mainly by HPLC upon prior extraction, which demanded relatively large quantities of samples.

In order

- to minimize the sample quantity
- and – above all – to avoid the extraction step

we developed a method using

pyrolysis coupled to capillary gas chromatography (Py-CGC),

preferentially linked to mass spectrometry (Py-CGC/MS).

Our studies encompassed

- 14 natural dyestuffs (e.g. purple, indigo, saffron, woad, etc) as well in isolated form as still attached to their supporting materials, and
- various supporting materials, such as wool, cotton, silk, paper and parchment.

Analysis are carried out by a modern pyrolyser in a 2-step method:

1) “thermal desorption” (up to 300°C: removal of volatile components without thermal decomposition) and
2) pyrolysis (750°C, yielding characteristic thermal degradation products)

For routine identification of isolated dyestuffs FID suffices, while for analyses of dyestuffs still attached to (e.g.) textiles coupling with MS (applied in selected ion monitoring mode) is mandatory.

We could show that by this method micro samples of ca. 0,2 mg of dyestuff still attached to e.g. 3 mg textile fibers were sufficient to yield unequivocal results.

* The present studies were carried out as one of our contributions to the multinational EU-Project “INCO CT 2005 015406 MED-COLOUR-TECH”

POSTER PRESENTATIONS

CHARISMA: Cultural Heritage Advanced Research Infrastructures: Synergy for a Multidisciplinary Approach to conservation / restoration

Maarten van Bommel, Ineke Joosten and Alberto de Tagle

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Recently a new European project has been started with the acronym CHARISMA, which stands for Cultural Heritage Advanced Research Infrastructures: Synergy for a Multidisciplinary Approach to conservation / restoration. In this project, 20 institutions from 11 different European countries collaborate. The project is divided in three main activities, Network, Access and Joint research laboratories.
The network activity is mainly focussed on the exchange of new developed information. In this activity, workshops, seminars and trainings will be organised, for conservation scientists, conservators and curators. Two of these workshops will be devoted to the dyeing of textiles and the preparation of organic pigments respectively.
The Access activity is developed to provide access to professionals from the European community and exceptionally outside of it to research capacities and knowledge from the partners of the CHARISMA consortium. Funding for this activity is available covering travel expenses to visit the CHARISMA partners and make use of their (scientific) archives. In addition, A mobile laboratory will be available in which research will be performed with transportable, non-invasive equipment. These equipments will travel, together with the scientists, to objects of art to carry out research requested from professionals in institutions outside the CHARISMA project. The results of this research will be owned by the requesting organization. Furthermore, projects can be sponsored in which specific objects may travel to large nuclear beam facilities of 4 partners of the CHARISMA consortium. A call for proposals will be done on the CHARISMA website so that the professionals can submit there projects which will be evaluated by an independent committee.
A third activity is Joint Research (JRA). In this component, a portal will be developed to give on-line information about the meta-data from the archives available. A second task of the JRA is the development of new, portable and non-invasive techniques which can be added to the mobile laboratory. The third task is devoted to the identification of organic materials in cross-sections, the improvement of a multispectral imaging system and to research devoted to identification of natural and synthetic

colorants. Since this last task might be of interest to the DHA public, a separate poster will be presented.

DYESTUFF ANALYSIS OF THE XVIth AND XIXth CENTURIES ETHNOGRAPHIC SILK TEXTILES FROM THE NATIONAL MUSEUM OF HISTORY OF AZERBAIJAN

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Reversed-phase HPLC with diode-array detection has been used for identification of historical textiles and dress specimens. The examined objects originate from XVIth and XIXth centuries and belong to the collection from The National Museum of History of Azerbaijan. Extraction from fibres was carried out with HCl/methanol/water (2:1:1) solution. The most important natural red, yellow and blue dyes were found in historical textiles and dresses. In this study, as the main individual chemical components of natural dyes, anthraquinone and flavonoid and indigotin dyestuffs including carminic acid, luteolin and indigotin were identified in the silk historical samples. Luteolin and indigotin were found in the same sample.

Problems Raised by the Chromatic Integration in the Restoration of Ethnographic Carpets

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One of the most common problems that occur in the restoration of textile objects is the chromatic integration, as sometimes it is difficult to know how the dyes evolve in time. In what concerns the restoration of ethnographic items it is most commonly agreed that the integrated areas should be visually imperceptible on the front of the object and marked on the back, as the aim of the restoration process is not only to stop the deterioration, but also to make the object fit to be exhibited.

Some of the carpet restoration interventions made before 1995, evolved in time from the aesthetic point of view of their chromatic integration, as the original colours and the dyes used for restoration faded in different ways. The poster shows eight examples of carpet restorations, five of them made in the Textile Conservation and Restoration Laboratory of The National Village Museum “Dimitrie Gusti” and three examples of carpets belonging to the collection of the National Museum of the Romanian Peasant. The difficulties encountered in making a research study, consisted in the fact that due to several movements of the location of the Laboratory of The National Village Museum “Dimitrie Gusti”, an important amount of the restoration documentation was lost, the existing one was not complete concerning the types of dyes that were used at the time and all the photographic documentation is black and white. In what concerns the three carpets belonging to the National Museum of the Romanian Peasant, the restoration interventions were made before entering the museum collection, so it was even more difficult to determine the type of dyes that were used. For these reasons, I also used some data obtained from four informers, two of them active or retired textile restorers from the Laboratory of The National Village Museum “Dimitrie Gusti” and the third a restorer that worked in both museums.[1] According to their information the most commonly used dyes were synthesis dyes, but there were some attempts of dying with natural vegetal dyes, according to some old recipes obtained from peasant informers or

[1] Informers: Gheorghe, Vasilica, textile restorer since 1981, Boţe, Ştefania , retired textile restorer, Dinuţă, Sterina, retired textile restorer, Capanu, Calliope, textile restorer

from the literature existing at the time. The analysis was made from the visual and aesthetic point of view.

FORMATION, HPLC ANALYSIS AND COLOUR MEASUREMENT OF THE NATURAL PIGMENT OBTAINED FROM WELD (*RESEDA LUTEOLA*)

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In this work, the natural pigments which aluminium-weld and tin-weld were obtained by means of $KAl(SO_4)_2.12H_2O$ and $SnCl_2.H_2O$, solutions from weld. High performance liquid chromatography (HPLC) with diode-array detection (DAD) method was utilized for the identification of the natural pigments. Reversed-phase HPLC with diode-array detection has been used in this identification. The extraction of dyestuffs from the natural pigments were carried out with HCl/methanol/water (2:1:1; v/v/v) solution. According to results of HPLC analysis of the natural weld pigments, it was determined that luteolin present in the natural pigments were precipitated by Al (III) and Sn (II). In this study, CIELAB values of weld pigments were measured.

Clothing and Identities.

New perspectives on Textiles from the Roman Empire

(DressID)

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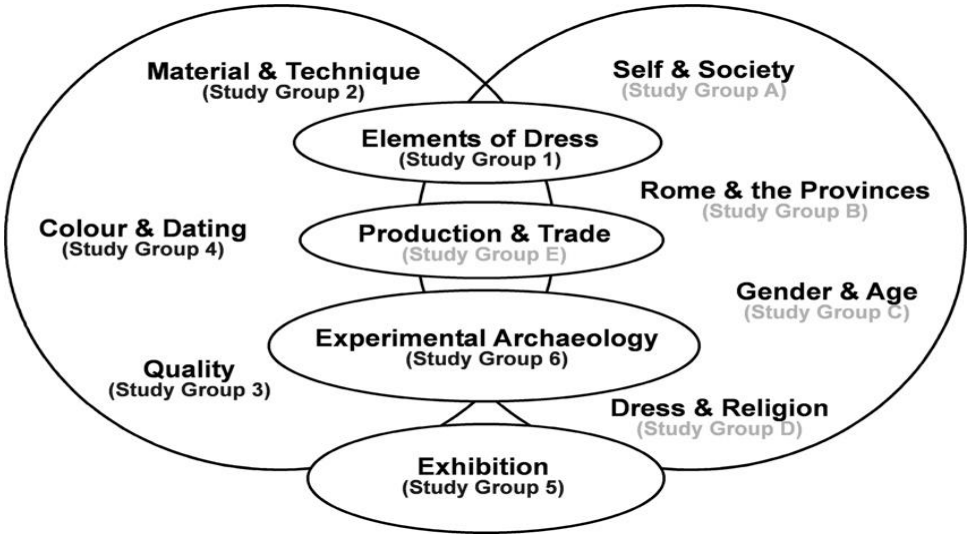
Since November 2007, a five-year cooperation project has started under the support of the Culture Programme of the European Union, titled: **"***Clothing and Identities. New perspectives on Textiles from the Roman Empire*" (Acronym DressID).

Co-organising institutions are the Reiss-Engelhorn-Museums (DE), the Centre for Textile Research (DK), the Royal Institute for Cultural Heritage (BE), the Universities of Crete (EL), Valencia (ES) and Sheffield (UK) and the Naturhistorisches Museum in Wien (AT) and many other indirect involved partners from the participating countries.

The main objectives of the project are to contribute to European identity by inquiring its common cultural heritage and roots on European level, to provide a position in cultural history for clothing and textiles in Antiquity, to achieve an awareness of clothing as key of identity, to strengthen the networks and exchange of knowledge and ideas of European scholars. This multidisciplinary approach combines and includes results gained by archaeology, ancient history, and epigraphy with physical and chemical analyses as well as systematically conducted tests of tools and techniques.

The research is organised as a network of study groups. These consist of researchers with various exploratory foci. It is their aim to interweave the specialists' knowledge into a large network of information on textile questions, and to bridge the ranges of specialised knowledge in order to get a broader view and a better understanding of the social significance of clothing in the Roman world.

Study groups one to six are dealing with empirical studies, typologies and classification, while study groups A to E rather focus on overarching questions and cultural-historical analysis



Study group 4 “Colour & Dating” is chaired by KIK/IRPA and focussing on the study of natural organic dyes and radiocarbon dating.

The main aim concerning organic dyes is to perform a more systematic study on the dye sources and technology used for dyeing textiles in the Roman Empire, stressing variations between different areas and cultures, and to study the evolution of the dyes applied within different periods of time. This will be achieved through small-scaled collection-related studies as well as through multidisciplinary studies on specific dyes with experts in the fields, including lab-research, written sources and archaeology. More information on the project is available on the web (www.dressid.eu).

Investigation of dyes used in textiles of Mount Athos

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Mount Athos has been an Orthodox spiritual centre since 1054 and has enjoyed an autonomous status since Byzantine times. Today, the “Holy Mountain” is still a major centre of the Christian religion with over 20 large, occupied and active monasteries. Peerless artworks of inestimable religious, spiritual and historical importance have been guarded by the monks for several centuries. Among them, important textiles can be found which have been barely studied.

Within the framework of the Byz-tex-Athos project (funded by the Getty Foundation), more than thirty artworks, which belong to the Monastery of Simonos Petra (IMSP) in Mount Athos will be investigated by physicochemical techniques to reveal the dyeing technology applied on these works. Liturgical garments and fabrics, worn by the priests-monks, are included in the selected textiles. The works are dated from 16th to 19th century. Tenths of microsamples, of different colours, have been extracted and are currently investigated by HPLC. The results, collected so far, suggest that cochineal, soluble redwood, weld, young fustic and indigoid dyes are among the colourants, which were used to dye the textiles. The reported results correspond only to a minor portion of the total number of works which will be finally studied. HPLC analyses are currently in progress and therefore the list of dyes contained in the selected textiles is expected to expand. Parts of the extracted microsamples will be studied by SEM-EDS to identify the mordant metal(s) used during dyeing.

PRODUCTION OF CARMINIC ACID PIGMENTS FROM COCHINEAL

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In this study, pigment production of deepful coloured, nontoxic, natural carminic acid from cochineal insects (*Dactylopius coccus* Costa) was purposed. With this aim, first the stability constants of the Al^{3+} and Sn^{2+} complexes of carminic acid were determined potentiometrically by using Irwing - Rossotti methods. The evaluated protonation constants of the ligand were found: log K_1 = 8,80 ; log K_2 = 5,95 and log K_3 = 2,62. For the metal complexes, logarithms of the stability constants were found for the aluminium complex: log K_1 = 12,26, log K_2 = 10,86 and for stannic complex log K_1 = 11,82 and log K_2 = 5,57. Conditional formation constants for complexes are calculated and pH ranges in the complexation are found. For optimizing the conditions for the extraction procedure, extracts from cochineal insects were analyzed with spectrophotometry and it was determined that 60 ^oC temperature in 10 minutes was sufficient. Determination of the quantitiy of carminic acid in the cochineal extract was found as % 10,69 with the spectrophotometric method and it was seen that this rate was equal with to the literature. With a definite pH rate, adding Al^{3+} and Sn^{2+} metal ions to the cochineal extract precipitation was realized, based on complex formation. Besides, based on the literature formation adding Ca^{2+} solution to it, it was seen that the precipitation became faster. More and bigger particles and the acquired metals had less solubility in water. After precipitation Sn^{2+}- cochineal Al^{3+}- cochineal and their Ca^{2+} salts were obtained. Their HPLC analyze was done. It was seen that the analyzed results were well adjusted with the standard carminic acid chromatogram.

CHARACTERIZATION OF NATURAL DYES FROM THE REFERENCE COLLECTION OF AMERICAN DYESTUFF OF THE SPANISH CULTURAL HERITAGE INSTITUTE (IPCE)

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We present a project under collaboration of the Spanish Cultural Heritage Institute (IPCE) and the Complutense University of Madrid (UCM), whose global aim is provide the IPCE's laboratories with validated HPLC-DAD methodology for analysis of dyestuff employed in the manufacture of ancient textiles. Targeted is also to extend available information by making use of state of art analytical technology such as LC-DAD-MS.

The IPCE holds a Reference Collection of about three hundred fibres of different nature, dyed with approximately two hundred American dyestuffs, several mordants and auxiliary products. This collection, as well as the book "*Dyes and Dyers from America*" (2006), is the result of a previous collaboration between the IPCE and research scientist Ana Roquero.

Investigation on dyestuff generally suffers from limited availability of suitable Reference Materials, dyed with the corresponding natural product and following the original procedures. Something contrary only applies to the European and Mediterranean ambit, where studies involving textiles are quite abundant, meanwhile investigations involving e.g. American textiles are rather scarce.

In the context of the said above, the aim of the present research project is to achieve two goals:

(1) method development and optimisation, including sample treatment and chromatographic parameters for analysis of natural dyes by HPLC-DAD and;

(2) application of these methods to samples from the Reference Collection of the IPCE.

In this study we present the results obtained for the analysis of several reference fibres belonging to the collection of the IPCE and dyed with a selection of red, yellow, blue, purple and black dyestuff. For some of this standard selection, the dye composition was already known but had to be validated, the constitution of others still remained unknown. After optimization of the chromatographic method, two extraction methods for dye were evaluated, using either methanol/hydrochloric acid extraction or a mild extraction with 5% formic acid in methanol. In both cases, an additional extraction step with methanol/dimethylformamide was employed. The obtained data constitutes the first milestone for an extensive characterization of this unique collection.

Traditional Greendyeing in Switzerland. A Retrospective View: Verena Zortea's Life and Work from "Oetzi" to "Cycle of the Year 2008"

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Verena Zortea, living in Horgen near Zurich in Switzerland, dedicated her whole life, work and private, to Natural Dyes and to women's traditional handwork. Until 1940, for women in the mountain regions of Switzerland it was just normal to be proficient in handwork such as weaving, embroidery and dyeing. At the age of about 30 years, V. Zortea was searching for a new orientation, decided to learn tapestry-weaving. But the dyed- merchandise available didn't correspond at all to her visual conception. Spontaneously she launched her first dye-experiment. Autodidact she acquired practical experience in dye-methods and botanical knowledge on dye-plants. Curiosity and fascination were pushing V. Zortea to explore the multiplicity of colours, hidden by the plants, showing up in an array of shades on the dyed yarn. Some years later, Emil Sprenger's book: "Färbebuch" 1969, became her "Dye-Bible". By now she is able to match almost any given sample with Natural Dyes. Since 1975 she works as an independent plant-dyer, a specialist for silk-dyeing. She works on customer request, often for textile artists. She acts as referent, or /and as consultant in different projects: in Italy at the South Tyrol Museum of Archaeology Bolzano for the Oetzi-project. In Switzerland for the Botanical Garden of Berne, as well as for the school for professional formation Berne and for the Pädagogik High School Zurich. She holds seminars and workshops in Germany at the Museum for Pre- and Early History in Frankfurt and in Kirghizia for an international project. As a colour sample base for remittance dyeing, V. Zortea and I realised from March to September a "colour chart" as "cycle of the year" by "green-dyeing" wool, using green plant material to receive varied colours. The research material and the illustrated samples are based on communication with V. Zortea and literature studies.

COLOURS AND MOTIF USED IN KUTAHYA TILES

Prof. Dr. *Nuran Kayabaşı, **Lecturer: Birnaz Er, **Lecturer: Sezin Kara
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Considering the cultures they have showed development and transition, Art of Tile making began in Anatolian territory with Uigurs and made progress with Great Seljuq Empire and became strong with Anatolian Seljuq Empire and in classical ottoman period, it peaked not only technically, but it also had its own distinctive structure. Developing technics and styles differ from according to different periods in these chronological classification.

Paints used in tile making obtained from local and foreign resources. Local paints used in tile making are usually got out of oxides that are bright green, turquoise, red, black. The most important colour used in tile making which is got out of cobalt oxide is blue. Paints which are obtained from foreign resources are yellow, dark green, and dark blue.

In this study, according to its period in tile making, we gave a brief information about colours and paints, which are feature of traditional Turkish tile art, which will be studied. We will emphasize past forms of composition and application of applied colours in today's tile making giving examples of application forms and application of colours and variations of post firing process in traditional Turkish tile art.

Painted pottery of Azerbaijan in the Hellenic period

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The most ancient patterns of painted pottery in Azerbaijan dated from the eneolithic period. From the mid of the 1st century BC the manufacturing of painted and dyed pottery developed more. Patterns of the painted pottery of that period revealed in Mingechevir, Gabala, Khynisly (Shamakhy), Mil plain and Aghjabedi, Shortapa (Barda), Garajamirli (Shamkir) and other archaeological monuments. Painted and dyed pottery found form these monuments distinguish with their artistic arrangement and ornamentation. Materials from studying monuments are to be found pottery with completely dying and painted. Archaeological materials prove that, on the North part of the Kura-river paint used in the artistic arrangement of vessels less than on the South part of the Kura. Thus, to the north part of Caucasus Albania it is more typical completely dyeing of pottery. The monochromic paint is typical for the Hellenistic vessels of Azerbaijan. The reddish-brown and dark-red paintings are usually applied on a reddish, dark-yellow and orange ceramic. The paintings applied both directly on a vessel surface and after slipping. In general, the paintings applied on a light background. The motifs depicted are: geometrical, plant decoration and pictorial. The geometrical motifs represent solid angles and triangles, wavy, single and parallel lines, zigzags and rhombs.

COLOURS AND PAINTS USED IN KUTAHYA TILES

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*Ankara University Household Economics Vocational High School Department of handicrafts,
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RESULTS OF OPTIMISATION STUDIES FOR MADDER DYEING*

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Aiming at optimisation of mordanting and madder dyeing the effect of dyeing parameters on colorimetric data (CIELAB measurement), on light fastness and wash fastness (ISO BS 1006: 1990COT), as well as on the stability of the textile fibre net (SEM analysis of sheep´s wool surface upon dyeing with madder) was investigated.

The differing parameters studied were: alum concentration, quantity of madder roots, dyeing time and temperature (whereby mordanting time and mordanting temperature were kept constant).

According to these studies (all of them carried out with 5 g sheep's wool) and taking colourquality and fibre stability into account the optimised parameters for dyeing sheep's wool with madder were:

Alum concentration: 6g/500ml
Quantity of madder roots: 15g/750ml
Dyeing temperature: 90°C
Dyeing time: 60min
Constant for mordanting: temperature (100°C) and time (60min)

* the present studies were carried out within the multinational EU-Project "INCO CT 2005 015406 MED-COLOUR-TECH"

Extraction of a red dye from a Kuwaiti desert plant (Al Kuhail) that has multiple medicinal application potentials.

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The air dried roots of Arnebia decumbens (Boraginaceae) were powdered and extracted using continuous soxhlet with different solvents to obtain maximum yield

Solvent Selection

Solvent	*Percentage leached*
Ethanol	**95.22**
Acetone	**54.08**
Methanol	**51.06**
Chloroform	**47.64**
Toluene	**40.56**
Ethyl acetate	**39.74**
n- hexane	**33.78**
Petroleum ether	**26.82**

The table above shows that the color extracted is water insoluble.The color is maximally obtained by ethanol.

The content of the crude material were specified by acid washed silica gel chromatography. Four different dyes have been identified : Shikonin ; deoxyshikonin acetylshikonin and isovaleryl shikonin

The red crude extract color could be changed to brownish – red by adding methanol ; bluish purple by adding ferric chloride or dark blue solution upon addition of alkaline solution.

The ethanol extract was used to color cotton and wool threads used for weaving rugs in Al- Sado society of Kuwait.

The color is fixed, it did not fade away washing with detergents or exposing it to the sun for a long period of time . This is because of the hydrophobic nature of the dye..

The anti microbial activity of the 4 compounds of the crude extract of Arnebia decumbens were tested against 5 microorganisms. The test resulted in positive effects on Bacillus subtilis ; Sarcina lutea ; Eacherichia coli ; Saccharomyces pastorianus and Candida albicans
The crude extract of Arnebia decumbens not only works as a coloring material but also protect the woolen rugs against moth destruction functions.

Natural Resources used by Church Painters in Northern Ethiopia, 2007

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There is a long tradition of covering the inside walls of Ethiopian churches with paintings of religious scenes.

Glossy house paints have now almost entirely superseded the water based natural colours and commercial powder paints that were used until the 1990s. The old water based colours are still used by the painters for illustrating manuscripts and for making paintings for the tourist industry.

In 2007 a study was made of the painting methods in use in a small area in the countryside south of Aksum, Northern Ethiopia. Some of the natural resources still used to make colours are described in this poster.

Dyeing of Silk Yarns with Important Some Dye Plants in Turkey

Assist.Prof.Dr. H.Sinem ŞANLI
Prof.Dr. Nuran KAYABAŞI
Assist. Prof.Dr. Feryal SÖYLEMEZOĞLU

The dyeing of silk yarns with vegetable dyes is mostly important in terms of the usage in high quality silk carpets. Within the vegetable dyes there are some important plants. In this study the plants which are used in carpets and give the red , yellow , green , brown and their tones ; and madder, walnut, camomile, aspir and sagetea will be used. With these plants dyeing will be made with the premordant method including nonmordant and mordant (aluminium alum, copper sulfate, iron sulfate, potassium bichromate and sodıum chloride). Two mordants will be used together. The light and friction fastness will be analysed.

DYEING, FASTNESS AND UV PROTECTION PROPERTIES OF NATURAL DYE

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A natural dye extracted from eucalyptus leaves has been applied on silk and wool fabrics by using two padding techniques, namely pad-batch and pad-dry techniques at different condition. Silk and wool fabrics dyed in the solution from leaves of eucalyptus extracted showed the shade of pale yellow to brown, excepting using ferrous (Fe) showing the shade of dark grayish-brown. Silk and wool fabrics treated with mordanted and dyeing process has presented the properties of colour fastness, washing, in very good level whereas colour fastness to light and rubbing was in fair to good level. It is observed that, with increase of dye concentration, UPF values increased. Wool fabric dyed by eucalyptus leaves extract with and without metal mordant has Excellent UV Protection (UPF values > 50) property. However, Good to Excellent UV Protection in silk fabric. In addition, darker colour such as Fe mordant provides better protection on account of higher UV absorption. The results confirmed that natural dye from eucalyptus leaves extract with metal mordants had potential applications for dyeing and UV Protective silk and wool fabrics.

IDENTIFICATION OF FLAVONOIDS IN AERIAL PARTS OF WELD (RESEDA LUTEOLA) EXTRACT, DYED SILK AND COLOUR MEASUREMENT

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Reversed-phase HPLC with diode-array detection has been used for identification of different parts of weld (*Reseda luteola*). Dried aerial parts and dyed silk samples were extracted two different methods. Zang and Laursen (1); and Wouters (2) methods were compared flavonoids and amount of flavonoids glicosides. Main component of weld is luteolin. Luteolin glicosides were higher than luteolin according to Zang and Laursen method, however, quantitative of luteolin was low in the weld. Also, amount of luteolin was higher than luteolin glycosides by Wouters method. In the study, CIELAB values of dyed silk with different parts of weld were measured.

1- X. Zang, R.A. Laursen, Anal. Chem. 2005, 77(7): 2022-2025.

2- J. Wouters, Studies in Conservation, 1985, 30: 119-128.

THE INFLUENCE OF DIFFERENT NATURAL DYES ON THE DEGRADATION OF THE CELLULOSE TEXTILE MATERIAL

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The poster deals with the influence of some chosen natural dyes on the chemical degradation of dyed vegetable fibres. The samples of dyed and undyed fabrics were artificially aged by high temperature in humid and dry atmosphere. The degradation of the textile material is determined from the changes of the polymerization degree of cellulose, its reducing power and solubility in alkali. Results of all measurements are compared and discussed. The influence of different dyes in company with the influence of the humidity on the chemical damages of the cellulose textile materials is evaluated.

AN EXTENSIVE STUDY OF THE EFFECT OF THE ENZYME PROTEASE THAT USED IN TEXTILE CONSERVATION ON COTTON FIBERS DYED WITH TURMERIC DYE, MADDER DYE.

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The enzymes have become widely accepted as some of the most useful reagents available to conservators. The application of protease enzyme on textiles is an efficient conservation method to remove animal glue adhesive and protein stains such as blood. The main advantage of using this enzyme is its specificity and efficiency to catalyze the hydrolytic cleavage of peptide bonds in proteins. The fibers that were used in this study were cotton dyed with Turmeric dye, madder dye mordanted with $CuSO_4$ or Ferric Citrate, as well as without mordant.

The effect of protease as a function of enzyme concentration and time of treatment on the color parameters was extensively studied. Among these parameters the total color change (ΔE), the change in color lightness (ΔL*), the change in red-green coordinate (Δa*), the change in yellow- blue coordinate (Δb*), the change in color chromocity (ΔC) and the change in color hue (ΔH) of Madder dye, Turmeric dye were included. Furthermore, the effect of protease on the morphology of the surface of the untreated and enzymatically treated cotton dyed fabric was investigated using SEM and Stereoscope. Also the effect of the enzyme on the mechanical parameters of cotton fibers (Tensile strength, Elongation, Crystallinity index) were studied by FTIR, XRD and ASTM method. The results show the effective role of protease in the conservation of textiles and no significant change was observed on the fiber due to the protease enzyme treatment.

CHARISMA, Joint research activity: From botanical source to analytical result

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Within the framework of CHARISMA, one Joint Research Activity (JRA) is devoted to the identification of organic materials; one specific task is focussed on organic colorants. The overall aim of this task is to get a better understanding of the effect growing a botanical source, dyeing or pigment preparation, sample pre-treatment and ageing on the interpretation of the analytical result. It is known that the composition of the colouring material in a dye source can be affected by the conditions of the environment, such as weather, soil etc. In addition, the recipe used to dye a textile or prepare an organic pigment can affect the colorant composition as well. Furthermore, the composition can be affected by ageing and the procedure used to extract the colorant from the sample.

In this project, we will focus on six well known sources, three related anthraquinone dyes (madder, wild madder, galium) and three related flavonoids dyes (weld, dyer's broom, sawwort).

From each species, several plants from different region will be collected and the dyestuff content will be analysed. Next, for each species several recipes will be followed to determine the composition of the organic colorants in the dye bath, on the textile or in the organic pigment. Mild extraction techniques will be investigated within a round-robin procedure to determine the effect on the analytical result. The photochemistry of organic pigments on different substrates (Al, Sn and Ca) in lipidic binding media will be examined as well.

As an overall result, we hope to gain more insight in the relevance of all these steps, what is their effect, how important is it and does it affects the final interpretation in samples which are analysed and from which the origin of the dye plant and the recipe is not known.

Besides the task devoted to natural colorants, a second task will start with the aim to develop analytical strategies to identify early synthetic dyes. Within this task both non-invasive and invasive techniques will be used, probably in a sequence to get a maximum amount of information from a minimal sample.

TANCY, Tanacetum vulgare, AS A SOURCE OF DYE AND DRUG

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Tancy, *Tanacetum vulgare,* is herbal plant from Asteraceae. Presumably, it has originally been grown in Europe or Asia, but it has spread all over the world with people. Nowadays tancy grows mainly in the northern hemisphere in Europe, Asia and North America but is found also in North Africa. Tancy is well known as a source of folk medicine. It has been used for cure of diseases of humans and domestic animals and also in the production of fragrances, cosmetics and balsams. It has been added to food as spice and preservative. Its' antimicrobial and insecticidal properties were known concluded from the tradition of collecting plants and bringing them inside houses and cowsheds. From the versatile use of tancy tell the old dyeing recipes, which show that the plant was known as a source of yellow dye. Tancy contains several bioactive terpenes, which form fugitive oils; also phenolic compounds are found.

Even though it is known that tancy is used as a source of yellow color, references to it in dyeing literature, especially in the older Scandinavian literature, are rare. It is obvious that tancy is not an indigenous plant in Scandinavia but rather an incomer, which has spread together with population. This explains the findings from the archives of Finnish folklore, which do not mention tancy as a source of dye. The Swede Johan Linder published the book Svenska färge-konst in 1720. He mentions tancy as a source of yellow colour when alum mordant was used. However, generally the plants that Linder mentions seem to be fairly unknown, not common and abundantly grown Swedish plants. In addition, another Swede Esther Nilsen (1973) mentions that according to 18 old dyeing books the most common yellow dye plants were imported and among the indigenous plants she does not mention tancy. The new Scandinavian dyeing literature from the 20th century, mentions tancy as a rich source of yellow and green colours.

The aim of this study was to increase the knowledge of colorants in tancy by investigating the dyeing properties of 20 tancy populations grown in different parts of

Finland. The research is part of a larger project which aims at sustainable agriculture, plant-derived pesticides and versatile utilization of new unusual cultivated plants.

Reference:

Keskitalo, M. 1999. Exploring biodiversity to enhance bioactivity in the genus *Tanacetum* through protoplast fusion. Ph.D. Thesis, University of Helsinki.

Dye Plants in Phytotherapy

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Plants are capable of carrying out the process of biosynthesis which leads to obtain organic compounds from inorganic compounds. The main products of plant metabolism are as following: proteins, fats and carbohydrates. Moreover, in the plant tissue, there are alos many other processes going on resulting in, among other things appearing dye compounds. Thanks to their characteristics such as colour and biological activity these species are commonly used in dyeing but also in food and pharmaceutical processing.
This work aims at showing medicinal properties of some dye plants.
In order to do the analysis 110 dye plants species were chosen, which gives a range of colours from yellow to black. The species are represnted mainly by perennials (48%) and almost all of them occur in Poland (93%). The discussed taxa (except one) reveal medicinal features.
34 of the described species are placed in Polish Pharmacopeia (edition VIIII, 2009). These plants provide dyes mainly of yellow, yellow-green and green. Dye compounds (such as: flavonoids, anthocyanins, xanthophylls) found in the plant tissues have therapeutic values. As a medicinal plants there are sources of two herbal meterial (19 species): herbs and leaves.
Plant drugs can be used in metabolic disorder regulation, the treatment of the digestive system, urinogenital system, vascular system and in fortifying the immune system as well.
The dye plants also contain significant amount of active compounds such as: tannins, glycosides, essential oil and also proteins, fats, carbohydrates, vitamins, microelements and previously mentioned dye compounds.
The discussed group of pharmacopeia dye plants is represented by, for instance, *Borago officinalis* L., *Polygonum bistorta* L., *Arctostaphylos uva-ursi* (L.) Spreng, *Sambucus nigra* L. and *Betula pendula* Roth. They have various life-forms such as: terophytes, hemicryptophytes, chamephytes, nanophanerophytes and megaphanerophytes.

A more detailed description of these crop plants constitutes a good example of unique and certain diverse medicinal features.

Ruth Funk Center for Textile Arts

Carla Funk
Florida Institute of Technology

This poster session introduces the newly opened Ruth Funk Center for Textile Arts located on the campus of Florida Institute of Technology in Melbourne, Florida, U.S.A. Founded in 1958, Florida Tech has become known worldwide as a premier technological university, offering undergraduate and master's programs in science, engineering, aeronautics, aviation, business, humanities, mathematics, psychology, communication and education; and doctoral programs in science, engineering, psychology, and science and mathmatics education.

The Ruth Funk Center for Textile Arts is the first visual arts museum on the University campus. Our mission is to promote the cultural understanding and appreciation for textiles, fiber arts and associated objects within the University and surrounding communities. As the only museum devoted to the collection and display of textiles and fiber arts in the southeastern United States, the Center is committed to being one of the most dynamic University-based visual art centers because of our unique focus.

Highlighting our diverse international collections, we will present a changing exhibit schedule that combines technological innovation, aesthetic beauty and ethnography. Such exhibits will be complemented by public programming that is interdisciplinary in its focus, encouraging creative collaborations among scholars, students and artists. We invite participants of DHA 28 to learn more about the Center and offer ideas for future programming.

Revitalisation of natural dyeing plants in INF & MP plantation

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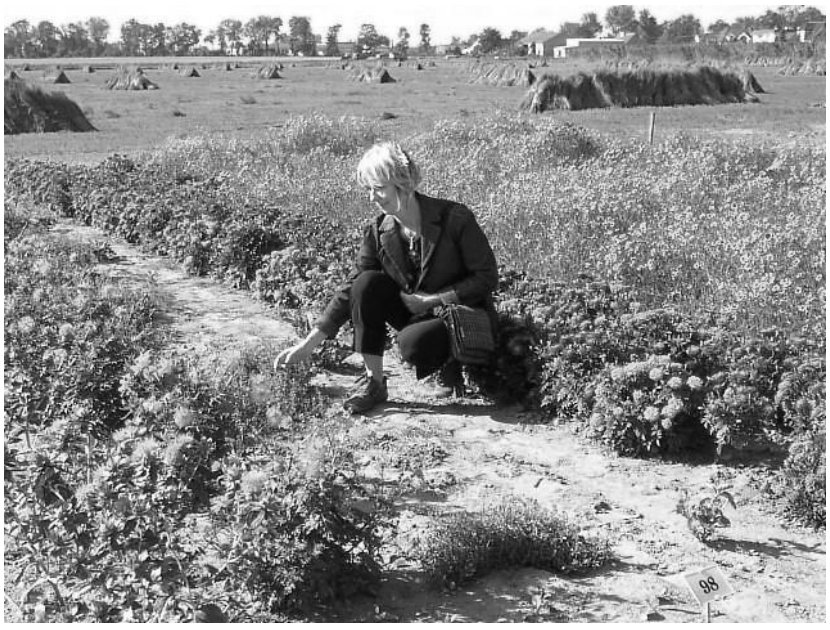
The aim of this presentation is to present the activities of :Laboratory of Natural Dyeing “Natural Art” and INF&MP Experimental Station in the area of cultivation, extraction and dyeing methods on linen and silk fabrics. The historical collection of the dyeing plants was established at INF&MP in 2003.

The purpose of creating it is sustaining and developing the offer with introducing new dyeing plants. The garden is going to be used as a place for trainings and experiments directed at agriculture, environmental protection students, artworks conservators and artists. Natural dyes are the sources of huge palette of colors with few limitations of fastness and brilliancy of shade. All the plants cultivated in our experimental station, except one are mordant dyes.



Experimental Station INF&MP, Pętkowo