Turkey red dyeing and printing

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Dumbarton Library,
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Turkey red

- Dyed on cotton with oil, alum, dung, blood, tannins and anthraquinone dyes
- Much admired for its fiery colour, durability and fastness.
- Unusual and distinct process that was not fully understood
- Historical samples found in many collections

University of Glasgow Archive Services, Records of United Turkey Red Co Ltd, GB248 UGD 13/8/8.

Bradford College Textile Archive, Turkey Red Collection, BRFCM2005.1.162

West Dunbartonshire Council Collection, Glasgow

Day dress (1825-1830) T.74-1988 Image courtesy of the V&A
Turkey Red Resources in the UK

Pattern books, Dyed and printed TR samples, export tickets, Printing blocks, Documents regarding the English Turkey red industry, Board of Trade Design Registers

**Glasgow**
*Scottish Business Archives, University of Glasgow*
[www.gla.ac.uk/services/archives](http://www.gla.ac.uk/services/archives)

*Dumbarton Library, West Dunbartonshire Council*
[www.west-dunbarton.gov.uk](http://www.west-dunbarton.gov.uk)

**Glasgow Museums**
[www.glasgowlife.org.uk](http://www.glasgowlife.org.uk)

**Edinburgh**
*National Museums Scotland*
[www.nms.ac.uk](http://www.nms.ac.uk)

**London**
*The National Archives, Kew*
[www.nationalarchives.gov.uk](http://www.nationalarchives.gov.uk)

*Victoria and Albert Museum, London*
[www.vam.ac.uk](http://www.vam.ac.uk)

**Bradford**
*Bradford College Textile Archive*
[http://textilearchive.bradfordcollege.ac.uk/](http://textilearchive.bradfordcollege.ac.uk/)

**Manchester**
*Greater Manchester County Record Office*
[www.manchester.gov.uk](http://www.manchester.gov.uk)

*Gallery of Costume, Platt Hall, Manchester*
[www.manchestergalleries.org](http://www.manchestergalleries.org)

*Museum of Science and Industry, Manchester*
[www.mosi.org.uk](http://www.mosi.org.uk)
An EU funded project aimed at providing light exposure guidelines for sustainable collections display and access of 19\textsuperscript{th} c. Turkey red. Identify materials and methods for 19\textsuperscript{th} c. TR
Terms used to describe Turkey red

- Rouge de Turc (Turkey red)
- Rouge d'Adrianople (Adrianople red)
- Levant red
- Rouge de Smyrne (Smyrna Red)
  - Levantine reference
  - Adrianopolis (Edirne, Turkey)
  - Smyrna (İzmir, Turkey)
- Rouge des Indes (India red)
  - ‘in manner of Indies’ or ‘equal to colour of Indies’

Variations of Turkey red processes in literature

- Papillon’s process
- Borelle’s process
- French process
- Glasgowian process
- German process
- Elberfeld process
- M. Hausmann process
- Steiner process
- Emulsion process
- Turkey red oil process
- Old process
- New process
- Alizarin oil process
Western Europe’s first Turkey red dye works

- Darnétal near Rouen
- Aubenas in Languedoc

Set up by Ferquet, Goudard and d'Haristoy around 1745 with the help of Greek dyers.

- Saint-Chaumont near Lyon (Charles Flachat)
- Nîmes (Simon Eymard)

In 1776, Pouce and Archalat, with French government assistance, hired a number of Greek dyers directly from Adrianople.

Between 1780 and 1790 the dyers of Rouen dyed it so well, that they obtained almost a monopoly of the market.
As the inclosed colour of crimson upon cotton is a new discovery and dyed by no other person at present but myself............

John Wilson (1761)

- First man in Britain to dye TR.
- Procured the secret of dyeing TR from Greek dyers of Smyrna in 1750s.
- Society of Arts awarded him premium twice, but reported that his dyeing lacked fastness compared with the imported article.

“The tediousness of so many operations, and the exactness required every time rendered it of no more value to me than the Madder red . . .” - WILSON, J.
After numerous failures, TR was eventually introduced in Manchester and Glasgow near the end of the 18th c.

French dyers Louis and Abraham Borelle demonstrated their method to the Manchester Chamber of Commerce and received a prize of £2500.

Another dyer from Rouen, Pierre Jaques Papillon submitted samples of his own Turkey-Red-dyed yarn to a member of the Manchester Chamber in February 1785.

Borelle’s method was published by Thomas Henry in Memoirs of the Literary and Philosophical Society of Manchester in 1790.
In 1785, Papillon came to Glasgow at the invitation of businessman George Mackintosh.

**Dalmarnock Turkey Red Works**

- Established in 1785 by Mackintosh and David Dale
- Henry Monteith acquired the business in 1805 (renamed **Barrowfield Dyeworks**), specialising in dye for bright red Bandanna handkerchiefs.

‘I have made a great improvement in his process. I dye in twenty days what he took 25 to do, and the colour better’ - Mackintosh (1787)
William Stirling and Sons
Dalquhurn and Cordale works

Archibald Orr Ewing and Co.
Levenbank, Milton and Dillichip works

John Orr Ewing and Co.
Croftengea and Levenfield works
(Alexandria works)

Amalgamated to form United Turkey Red Co Ltd (1898)

1982.16 Ticket Notebook
West Dunbartonshire Council Collection, Glasgow
Turkey red export markets

1982.16 Ticket Notebook
West Dunbartonshire Council Collection, Glasgow

https://www.gracesguide.co.uk/File:United_Turkey_Re
d_Co_1920RD.jpg
Papillon’s Process for Dyeing of Turkey-red yarn

1. Treatment with **Alicate Barilla, pearl ash and Lime**; Wash and dry

2. **Gray Steep**
   - Three successive treatments with **Barilla, Sheep dung, oil of vitriol, gum arabic, sal ammoniac, Olive oil** (24 h each): Wash and dry

3. **White Steep**
   - Same as step 2 (just omit the sheep’s dung)

4. **Gall steep**
   - Steep with **gall solution** for 24 h; wring and dry without washing

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First alum steep
- Steep in a solution of **alum and barilla** for 24 h;
- Wring and dry without washing

Second alum steep
- Same as step 5; additionally steep for 6 h in river, wash and dry

Dyeing
- Boil in a mixture of **madder and blood** for 1 h; Wash and dry

The fixing step
- Treat with a mixture of **Gray and white steep liquor**; Dry without washing

Brighton step
- Treat with a mixture of **soap and barilla** for 2h; Wash and dry

(1804) V. Account of the process followed by M. Pierre Jaques Papillon for dyeing Turkey red, Philosophical Magazine Series 1, 18:69, 43-47.
Steiner’s Process for Dyeing of Turkey-red Cloth
J. J. Hummel, 1886, The dyeing of Textile fabrics – 3rd Ed.

**Bleaching**
Boil the fabric with water, followed by two boiling operations in **caustic soda**; steep in **sulphuric acid**; Wash and dry

**Oiling**
Pad the clothes in the open width in **olive oil** at 110 °C; Dry in oven

**Liquoring**
Pad the cloth **seven times** in the open width through a solution of **carbonate of soda**; Dry in oven after each padding operation

**Steep in carbonate of soda solution and then in water. Wash and dry**

**Aluming**
Treat with a solution of **alum, carbonate of soda and tin chloride**

**Dyeing**
Boil in a mixture of **alizarin, ground sumach, blood and chalk**; Wash

**Clearing**
Treat with a mixture **soap, carbonate of soda and tin crystals**; Wash and dry
A simplified flowchart of TR process

- Cleaning or bleaching
- Dunging (Optional)
- Oiling
- Tanning (Optional)
- Mordanting (Aluming)
- Dyeing
- Clearing

Archibald Orr Ewing (AOE) dyestuffs ledger
University of Glasgow Archive Services, Records of United Turkey Red Co Ltd, GB248, UGD13/4/1.
Turkey red dyeing process

Oiling

- Olive oil
- Castor oil
- Turkey-red Oil
- Sesame oil
- Linseed-oil
- Fish oil

- Repetitive treatment with rancid olive oil mixed with alkali, and frequently cow or sheep dung followed by wringing, washing and drying

- 1870’s – Turkey red oil introduced – one step oiling.
Tanning

- Sumac leaves
- Gallnut
- Tannins

- Optional step; however, most TR process descriptions included this step.
- Introduces tannins to the fibre and renders it capable of fixing a larger quantity of 'mordant' and helps in ultimately acquiring a fuller colour.

Tanning with sumach leaves
Mordanting

- Because of strong affinity of aluminum ions towards cellulose fibres and anthraquinone dyes, it could readily serve as a bridge between the fiber and dye.
- A typical mordanting bath was prepared by making an alkaline solution of an aluminium salt with soda ash.
- Well-oiled cotton (often tanned) were mordanted in prepared mordant bath at elevated temperature.

Aluminium salts
- Potash alum
- Sod alum
- Aluminium acetate
- Aluminium sulphate
- Aluminium formate
- Aluminium oxide

Mordanting with aluminum acetate
Use of dung and blood

- Blood
- Blood albumen
- Cow or Sheep dung
- Intestinal fluid of slaughtered animals
- Dung Substitute
  - Phosphates
  - Arsenates
  - Silicates
  - Gelatine

- Concept of animalization
- Bleaching and brightening effect
- Removal of superfluous mordants

Phosphate treatment
Rubia tinctorum

• Common madder/Dyer’s madder

• Because of higher concentration by weight of dye molecules (specifically alizarin)

• The varieties of madder in commerce were distinguished by the name of the country of origin.

• Britain was the largest consumer of madder in the mid-19th c., its textile industry taking about a third of world export.

  ‘In 1859 the Dalquhurn works of Stirlings at Renton were dyeing 18 million yards of Turkey Red fabric and 800,000 lb. of Turkey Red yarn per annum.’ R. A. Peel, 1962, JSDC

• The amount of madder consumed by the Turkey red industry, its cost, and the transport required to ship it to dyehouses motivated dyers and chemists to find a more efficient alternatives.
Garancine and other semi-synthetic madder products

• Robiquet and Colin (1826) isolated the coloring principles of madder – alizarin and purpurin.

• Concentrated madder products - Garancine, colorine and garanceux

• Most important of these concentrated madder derivatives was garancine, patented by Colin, Robiquet, and Lagier in 1828.

• Within a decade it was adopted in the French dyeing centres of Rouen and Alsace.

• In 1843, Fredrick Steiner patented a method of producing garancine from refuse madder

• Garancine - an intermediate product overlapping the use of both madder and alizarine.

• The AOE dyestuffs ledger records the use of garancine in Turkey red dyeing upto 1886.
Alizarin

• By the mid-1870s alizarin superseded madder in the Turkey red industry.

• The AOE ledger provides concentrations, amount and price of alizarin used, but no manufacturer is identified.

• The archive contains three contracts for synthetic alizarin
  ✓ 1898 with the British Alizarine Company
  ✓ Two from 1899 and 1900 with Meister Lucius & Brüning

• Turkey Red oil patent (1872) and introduction of short process by the use of the alizarin on TRO.
Dyeing

Dyeing with madder root extract
Clearing

Clearing with Marseilles soap
Common dyeing

Madder

Alizarin

Turkey red dyeing
Turkey red discharge printing

Mordant the cotton fabric - olive oil emulsion and alumina (several day process).
Dye with madder (alizarin) 200°F blood albumen, sumac, chalk - 2 hrs.
Clear with soap, Sn XG under 8 lb. pressure (Cu kiers).
Warm air dry.

Print:
- White: citric acid (subsequent 'wash' in Ca hypochlorite gave the 'acid' white).
- Blue: Prussian blue print.
- Yellow: Lead salts print - after bichrome.
- Green: Above blue on yellow.
- Black: logwood.

3.5.68
Turkey red discharge printing process

White
- Make a acidified paste with thickening agent
- Apply to the cloth using the printing block or pattern roller.
- Pass through the liquid bleach which reacts with this paste, removing the colour only in where the pattern is.

Blue
- Acidified paste with a bleach-resistant blue dye

Yellow
- Acidified paste mixed with lead nitrate.
- After bleaching the fabric, dip it in another solution of potassium bichromate.

Green
- Combination of blue and yellow

Black
- Acidified paste mixed with logwood extract
Creating Turkey red imitation at home

Process

**Oiling**
- Make an emulsion of olive oil in water with little washing soda
- Saturate the cotton fabric with prepared emulsion
- Squeeze and dry
- Repeat multiple times

**Tanning**
- Boil dried pomegranate peel in water and filter
- Steep the oiled cotton in above solution at 60-70 °C for an hour
- Wash and dry

**Mordanting**
- Dissolve 40% owf alum in water and add some washing soda
- Steep the tanned cotton in alum solution for two hours at 60-70 °C.
- Wash and dry

**Dyeing**
- Steep 100% owf powdered madder root in water overnight. Filter and collet the extract and add some chalk powder.
- Steep the mordanted cotton in dye solution for half hour at room temperature.
- Raise the temperature to boiling and keep dyeing for half hour
- Wash and dry

**Clearing**
- Make a soap solution in water and add some washing soda
- Dip the dyed fabric in cold soap solution, raise the temperature slowly to gentle boil
- Remove, wash and dry

**Materials required**
- Cotton fabric
- Olive oil
- Washing soda
- Pomegranate peel
- Alum
- Madder root
- Chalk powder
- Soap
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