The Natural Dyes as Applied to Wool.

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The work described in this brief memoir was undertaken some five years ago, and from causes unseen at that time the publication has been delayed until the present.

As originally designed, the work was merely the preparation of a large series of samples of wool dyed with various natural dyestuffs and common mordants as an exhibit of this branch of the dyer's art now rapidly going out of use.

During the prosecution of the work it was seen that a valuable comparative method of testing these dyes might be evolved from the facts as recorded in the results of these tests.

The samples were prepared from pieces of woollen flannel of known purity weighing ten grams each, washed, mordanted in the proper baths, washed again, and dyed in a bath of the dye carefully prepared, the conditions differing with the various dyestuffs.

225 samples were made, with 5 mordants, the list including the following dyestuffs:—

Brazil-wood,	Catechu,
Peach-wood,	Quercitron,
Lima-wood,	Barberry root,
Bar-wood,	Sumach,
Sapan-wood,	Saffron,
Cam-wood,	Weld,
Hypernic,	Fustic,
Cudbear,	Turmeric,
Cochineal,	Persian berries,
Madder,	Logwood,
Anatto,	Tannin.
Lac,	

The method proposed for testing or valuation of a dyestuff is briefly as follows:—

For instance, logwood: Ten grams of flannel are mordanted with alumina sulphate for one hour at 212° F., then cooled, washed, and divided in two equal parts; one part is dyed in a 10 per cent. bath of standard chips for one hour at 212° F. and the other part in a 10 per cent. bath of the logwood to be tested under the same conditions. The two pieces are finally removed from their respective baths, dried, and compared as to shade. It is well to have a few samples of 1, 2½, and 5 per cent. standard dye for comparison. With a little practice the shade may easily be matched within 1 per cent. It is best always to choose the brilliant shades for comparison. I have had no difficulty in keeping standard samples, provided they are protected from strong sunlight.

The following formulæ used in these tests will be found inter-

esting. The figures are always based on the 10 gram swatch of wool:—

BRAZIL-WOOD.

No. 1 (10106, 10107 R, 10108 R).

Wood		5.0	gms.
Alum		0.4	gm.
$K_2C_2O_4$		0.2	"

1½ hours at 100° C.

Bluish-red.—No. 10106.

Mordant $Al_2(SO_4)_3$		0.4	gm.
$K_2C_2O_4$		0.2	"

Boil 1–1½ hours, wash, dye in separate bath ½–1 hour at 80°–100° C. 5.0 gms. dye-wood; add to dye-bath 0.6–1.2 gms. $CaCO_3$, also solution of glue. (See Lima-wood.)

Peach-wood same.

No. 2 (10112) $K_2Cr_2O_7$.

$K_2Cr_2O_7$		0.3	gm.
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Boil for 1½ hours; take out, wash, and boil in the dye-bath

for 1 hour.

Wood		5.00	gms.
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No. 1 (10110) $FeSO_4$.

Boil in a bath of the

Wood		5.00	gms.
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for 1 hour, then "sadden" in a bath of

$FeSO_4$		0.500	gm.
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Boil for ½ hour.

No. 2 (10111) $CuSO_4$.

Same as above, but use $CuSO_4$ instead of Iron.

$CuSO_4$		0.8000	gm.
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No. 3 (10109) $SnCl_2$.

Boil in the mordant for 1 hour.

$SnCl_2$		0.100	gm.
Tartar		1.600	gms.

Take out, wash, and dye

Wood		5.00	gms.
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Boil for 1 hour.

HYPERNIC.

Stannic tin.

$SnCl_4$ (10030)		0.4	gm.
Tartar (10031)		3.0	gms.
HCl (10047)		3.0	"
Water, dist.		1.5	liters.

Boil for $1\frac{1}{2}$ hours; take out, wash, and dye in a bath of

Wood		7.0 gms.
Water, dist.		1.5 litres.

Boil for 1 hour with frequent agitation; take out and wash.

Red-wood same way, but use 8.0 gms. of wood.

No. 10162.

Boil in a bath of

Wood		6.000 gms.
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for 1 hour, then wash and sadden in the alumina bath

$\text{Al}_2(\text{SO}_4)_3$		1.000 gms.
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Boil for 1 hour.

No. 10161.

Boil in CuSO_4 for $1\frac{1}{2}$ hours

CuSO_4		0.800 gm.
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Take out, wash, and dye in a separate bath

Wood		6.00 gms.
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Boil for $1\frac{1}{2}$ hours.

PEACH-WOOD.

No. 1 (10150, 10151) $\text{K}_2\text{Cr}_2\text{O}_7$.

$\text{K}_2\text{Cr}_2\text{O}_7$		0.300 gm.
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Boil for $1\frac{1}{2}$ hours; take out, wash, and dye in a separate bath

Wood		4.000 gms.
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No. 2. Same as No. 1, using

Wood		6.000 gms.
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No. 1. $\text{Al}_2(\text{SO}_4)_3$.

$\text{Al}_2(\text{SO}_4)_3$		0.400 gm.
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$\text{K}_2\text{C}_2\text{O}_4$		0.200 "
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Boil $1\frac{1}{2}$ hours; take out and wash; dye in a separate bath

Wood		4.000 gms.
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No. 2. Same as No. 1, using

Wood		6.000 gms.
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No. 10155, 10156, 10157, Al, Sn, and Tartar.

$\text{Al}_2(\text{SO}_4)_3$		0.600 gm.
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SnCl_2		0.100 "
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Tartar		0.500 "
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(1) 40 per cent. of wood.

(2) 60 " " "

(3) 20 " " "

No. 3 (10155) Al.

Boil in a bath of

Wood		6.000 gms.
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Chalk		0.600 gm.
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for one hour; take out, wash, and sadden in a bath of

$\text{Al}_2(\text{SO}_4)_3$		0.600 gm.
Tartar		0.500 "

Boil for $\frac{1}{2}$ – $\frac{3}{4}$ hour.

No. 4 (10154) SnCl_2 .

Boil in a bath of

SnCl_2		0.200 gm.
Tartar		0.500 "
(HCl)		q. s.

for $1\frac{1}{2}$ hours; take out, wash, and dye in a bath of

Wood		6.00 gms.
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Boil for 1 hour. Use distilled water.

No. 1 (10153) FeSO_4 .

Boil with

Wood		6.00 gms.
CaCO_3		0.800 gm.

for 1 hour; take out, wash, and sadden with

FeSO_4		0.500 gm.
Tartar		0.800 "

Boil for $\frac{1}{2}$ hour.

No. 2. CuSO_4 .

Boil with

Wood		6.000 gms.
Chalk		0.800 gm.

for 1 hour; take out, wash, and sadden in a bath of

CuSO_4		0.800 gm.
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Boil for $\frac{1}{2}$ hour.

REDWOOD.

No. 1.

$\text{K}_2\text{Cr}_2\text{O}_7$		0.200 gm.
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Boil for $1\frac{1}{2}$ hours, and dye in a separate bath

Wood		4.0–8.0 gms.
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No. 2 (10115) Alumina.

Boil the wool first with 2.0–8.0 gms. of the wood for 1 to $1\frac{1}{2}$ hours; then boil in a separate bath of

$\text{Al}_2(\text{SO}_4)_3$		0.100 gm.
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BAR-WOOD.

No. 1 (10113) SnCl_2 .

SnCl_2		0.100 gm.
Tartar		1.6 gms.
(HCl)		q. s.

Boil for $1\frac{1}{2}$ hours; take out, wash, and dye in a separate bath

Wood		8.00 gms.
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Boil for 1 hour. Use distilled water.

No. 2 (10114) CuSO_4 .

Boil with wood for 1 hour

Wood 8.00 gms.

then sadden in a bath of

 CuSO_4 0.800 gm.Boil for $\frac{1}{2}$ hour.

No. 3. Same as No 2, but sadden with

 FeSO_4 0.500 gm.

No. 4.

 SnCl_4 1.6° 0.4-0.6

Tartar 4.0-16.00 gms.

Mordant $1\frac{1}{2}$ -2 hours; wash and boil 1-2 hours. 4.0-8.0 gms.
wood.

Bar-wood = Crimson.

Cam-wood = Purplish-red.

Sanders-wood = Yellow-red.

Stuffing and Saddening.—Boil with

Wood 8.0 gms.

Water, dist. 1.5 liters

for 1 hour; take out, wash, and sadden in a bath of

 SnCl_2 0.4 gm. HCl 2.0 cc.

Water, dist. 1.5 liters.

Boil $\frac{3}{4}$ hour; take out and wash thoroughly.

Nic-wood.

No. 1. $\text{K}_2\text{Cr}_2\text{O}_7$.

Boil with

 $\text{K}_2\text{Cr}_2\text{O}_7$ 0.300 gm.for $1\frac{1}{2}$ hours; take out, wash, and dye in a bath of

Wood 5.000 gms.

Boil for 1 hour.

No. 2. FeSO_4 .

Boil with the wood first

Wood 5.000 gms.

for 1 hour; take out, wash, and sadden with a bath of

 FeSO_4 0.400 gm.Boil for $\frac{3}{4}$ hour.No. 3. CuSO_4 .

Same as No. 2, only sadden with

 CuSO_4 0.400 gm.Boil for $\frac{3}{4}$ hour.

No. 4. SnCl_2 .

Boil in a bath of

 SnCl_2 0.2000 gm.

Tartar 0.4000 "

 HCl q. s.for $1\frac{1}{2}$ hours; take out, wash, and boil in a bath of

Wood 5.000 gms.

for 1 hour. Use distilled water.

No 5. $\text{Al}_2(\text{SO}_4)_3$.Boil in the mordant for $1\frac{1}{2}$ hours $\text{Al}_2(\text{SO}_4)_3$ 0.600 gm.

Tartar 0.500 "

Take out, wash, and boil for 1 hour.

Wood 5.000 gms.

LIMA-WOOD.

No. 10142, 10148.

Wood 5.00 gms.

Boil for 1 hour; then take out, wash, and sadden with

 CuSO_4 0.800 gm.Boil for $1\frac{1}{2}$ hours.

No. 10141.

Wood 5.00 gms.

Boil for 1 hour; take out and sadden in a bath of

 FeSO_4 0.500 gm.

Boil for 1 hour.

No. 1.

Dye-wood 5.00 gms.

 $\text{Al}_2(\text{SO}_4)_3$ 0.400 gm. $\text{K}_2\text{C}_2\text{O}_4$ 0.200 " $1\frac{1}{2}$ hours, 100°C .*Purplish slate*.—No. 2 (10143, 10144, 10149) 0.3 gm. $\text{K}_2\text{Cr}_2\text{O}_7$.

Wash and dye in a separate bath

Dye-wood 1.00 gm.

Brown.—No. 3.

Dye-wood. 5.00 gms.

Chalk. 0.2 gm.

3–5 per cent. Chalk makes shade bluer.

Bluish-red.—No. 4 (10140). $\text{Al}_2(\text{SO}_4)_3$ 0.6 gm.

Cream Tart. 0.5 "

Chalk 0.5 "

Wash and dye in separate bath $\frac{1}{2}$ –1 hour 80° – 100° 4.0–60 gms. dye-wood; add 2–6 per cent. Chalk. Brighter reds by adding to mordanting bath 1 per cent. SnCl_2 and same amount old Fustic.

CAM-WOOD.

Claret-brown.—No. 1 (10120), 40 per cent. No. 2 (10121), 80 per cent.

0.5–2.0 gm. $\text{K}_2\text{Cr}_2\text{O}_7$ dye in separate bath 4.0–8.0 gms. dye-wood; or,

Boil wool 1–2 hours in bath of 4.0–8.0 gms. of dye-wood, to a very full brownish-red color; then in same, or, better, separate bath of 0.2 gm. $\text{K}_2\text{Cr}_2\text{O}_7$, $\frac{1}{2}$ hour.

Pink.—No. 3 (10122) 10 per cent. No. 4 (10123), 40 per cent. No. 5 (10124), 80 per cent.

Boil with 1.0 gm. wood 1–2 hours and dye in 1.0 gm. $\text{Al}_2(\text{SO}_4)_3$ in separate bath.

40 per cent., red; 80 per cent., deep red.

No. 1 (10125) SnCl_2 .

SnCl_2		0.100 gm.
Tartar		1.000 "
(HCl)		q. s.

Boil for $1\frac{1}{2}$ hours; take out, wash, and dye in a separate bath

Wood		5.00 gms.
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Boil for 1 hour. Use distilled water.

No. 2 (10125) CuSO_4 .

Boil in a bath of the wood for 1 hour.

Wood		5.000 gms.
CaCO_3		0.100 gm.

Take out, wash, and sadden with

CuSO_4		0.800 "
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Boil for $\frac{1}{2}$ hour.

No. 3. FeSO_4 .

The same as No. 2, but use FeSO_4 . . . 0.500 gm.

SAPAN-WOOD.

No. 10135, 10136. Sn.

SnCl_2		0.100 gm.
Tartar		1.600 gms.

Boil for $1\frac{1}{2}$ hours; take out, wash, and dye in a bath of

Wood		5.00 gms.
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No lime-salts must be present. Use distilled water.

No. 10138.

CuSO_4	0.800 gm.
Boil for $1\frac{1}{2}$ hours; take out, wash, and dye in a bath of	
Wood	5.000 gms.
Chalk	0.800 gm.
Boil for 1 hour.	

NOTE.—To mordant wool efficiently with Aluminium Sulph., prepare the following solution:—

H_2O	1000.00 gms.
$\text{Al}_2(\text{SO}_4)_3$	8.00 "
Tartar	7.00 "

Immerse the wool in the cold solution; raise the temperature gradually to the boiling-point in the course of $1-1\frac{1}{2}$ hours; continue boiling $\frac{1}{2}$ hour longer, then wash well.

COCHINEAL.

Reddish-purple.—No. 1 (10065).

CuSO_4	1.00 gm.
Boil $\frac{3}{4}$ hour; take out and wash well.	
Cochineal	1.2 gms.
in separate bath. Boil 1 hour.	

Purplish slate.—No. 2 (10061).

FeSO_4	0.8 gm.
Tartar	2.00 gms.
Boil $\frac{3}{4}$ hour; take out, wash, dye in separate bath for 1 hour at 100°C .	
Cochineal	1.2 gms.

Purple.—No. 3 (10064).

FeSO_4	0.4 gm.
$\text{K}_2\text{C}_2\text{O}_4$	0.4 "
Cochineal	1.2 gms.
Enter flannel at 50°C .; raise to boil; boil 1 hour.	

Cochineal Spirits.—No. 1 (10050).

HCl	100 gms.
Sn	$12\frac{1}{2}$ "
Cochineal	1.0 gm.
Tartar	0.5 "
Spirits	1.5 gms.
Boil 20 minutes, cool down; enter wool, boil 1 hour; soak over night.	

No. 10051. Same, using 0.5 dye, 0.3 Tartar, 0.8 cc. Spirits.

No. 10052. Same, using 0.1 dye, 0.1 Tartar, 0.2 cc. Spirits.

No. 2 (10061, 10062).

FeSO₄ 0.8 gm.

Tartar 0.2 "

Boil $\frac{3}{4}$ hour; take out, wash, and dye in separate bath for 1 hour

Cochineal 1.2 gms.

Cochineal crimson.

Al₂(SO₄)₃ 0.4 gm.

Tartar 0.5 "

Mordant; wash and dye 1-1 $\frac{1}{2}$ hours

Cochineal 0.8 "

Scarlet.—No. 1.

Mordant 1-1 $\frac{1}{2}$ hours with 0.6 gm. SnCl₂, 0.4 gm. Tartar; wash, and dye in 0.5 gm. Cochineal 1-1 $\frac{1}{4}$ hours; enter wool in mordanting and dye-baths at 50° C. and raise gradually to boiling.

No. 2.

Bath $\frac{1}{2}$ full of water.

H₂C₂O₄ 0.6 gm.

SnCl₂ 0.6 "

Cochineal. 0.5 "

Boil 5-10 minutes; fill bath with cold H₂O; introduce wool; heat to boiling $\frac{3}{4}$ -1 hour; boil $\frac{1}{2}$ hour.

Use SnCl₂ in solution. A moderate amount of HCl is advantageous.

Cochineal Spirits.—No. 10050.

Cochineal (10014) 1.000 gm.

Tin Spirits (10040) 0.100 "

Water, dist. 1.5 liters.

Mix the Cochineal (ground) with water to a thin paste; add Tin Spirits, dilute with water, heat to boiling, and continue 15 minutes; then cool to 180° F., enter wool, raise to boiling, and continue for 1 hour, or until the bath is exhausted; allow to cool in the bath, then take out and wash in warm water.

No. 10059, 10060.

Cochineal with K₂Cr₂O₇, 0.2 gm. and 0.3 gm. H₂SO₄, conc. gives purple.

Cochineal crimson.—No. 1 (10053).

Al₂(SO₄)₃ 0.4 gm.

Tartar. 0.5 "

Boil 1-1 $\frac{1}{2}$ hours.

No. 2.

Cochineal 8.0-15.0 gms.

Cochineal scarlet.—No. 2 (10054, 10055).

First method: Mordant 1-1½ hours with 0.6 gm. SnCl₂ cryst., 0.4 Tartar; wash, and dye in 1.2 gms. Cochineal 1-1¼ hours; enter wool in mordanting and dye-baths at 50° C. and raise gradually to boiling.

No. 3 (10056).

Second method: Bath ½ full of water

Oxalic Acid 0.8 gm.

SnCl₂ 0.6 "

Ground Cochineal. 1.2 gms.

Boil for 5-10 minutes; then fill bath with cold water, introduce wool, heat to boiling-point (¾-1 hour), and boil ½ hour. Bath not exhausted in this method.

Deficiency of tin causes dull bluish-red; an excess makes the scarlet paler.

LAC.

Dye 1.00 gm.

SnCl₂ 0.600 "

HCl q. s.

Oxalic Acid 0.600 gm.

Boil 1½ hours. Add the HCl to the dye and allow to stand over night.

Chromium.

K₂Cr₂O₇ 0.3 gm.

Same amount of Lac as above. Mordant; wash, and dye in separate bath 1½ hours.

Alumina.

Al₂(SO₄) 0.4 gm.

Tartar 0.5 "

Mordant; wash, and dye.

Copper.

CuSO₄ 1.0 gm.

Iron.

FeSO₄ 0.8 gm.

Tartar 2.0 gms.

Scarlet Lac Spirits.

Solution—

HNO ₃	.	.	.	.	.	20	gms.
HCl	.	.	.	.	.	10	"
H ₂ O	.	.	.	.	.	20	"
Sn	.	.	.	.	.	6	"
Lac	.	.	.	.	.	1.5	"
Tartar	.	.	.	.	.	0.5	gm.
Spirits	.	.	.	.	.	1.5	gms.

Boil 20 minutes, cool down; enter wool, boil 1 hour; soak over night.

No. 2 (10068, 10069).

Dye	.	.	.	.	.	1.5	gms.
SnCl ₂	.	.	.	.	.	0.6	gm.
Oxalic Acid	.	.	.	.	.	0.6	"
HCl	.	.	.	.	.	q. s.	

Boil 1½ hours. Enter wool cold; raise to boil slowly.

Note well.—Add HCl, 4 or 5 drops, to about 25 cc. H₂O; rub this up with the dye and allow to stand over night.

MADDER.

Red.—No. 1 (10077).

Mordant first—

Al ₂ (SO ₄) ₃	.	.	.	.	.	0.6–1.0	gm.
Tartar	.	.	.	.	.	0.5–0.8	"
Madder	.	.	.	.	.	6.0–8.0	gms.

Begin dyeing at 40° C.; raise to 80°–100° C. during 1 hour, continue 1 hour, wash, and dry.

The shade is brownish-red, brightened by adding small amount SnCl₂ to dye-bath at close of operation; better colors, 1–2 per cent. weight of Madder in Chalk.

The best results are obtained at 80° C.; add 0.6 gm. Sumach to bring out color.

Orange.—No. 2 (separate bath).

SnCl ₂	.	.	.	.	.	0.8	gm.
Tartar	.	.	.	.	.	0.4	"
Madder	.	.	.	.	.	6.0	gms.

No. 2 a. Same (single bath).

SnCl ₂	.	.	.	.	.	0.4	gm.
H ₂ C ₄ H ₄ O ₆	.	.	.	.	.	0.2	"

Brown.

CuSO ₄	.	.	.	.	.	0.6	gm.
Tartar	.	.	.	.	.	0.4	"

Mordant and dye.

Dark brown.

FeSO₄ 0.8 gm.
Tartar 0.3 "

Mordant and dye.

Reddish-brown.—No. 10077.

K₂Cr₂O₇ 0.3 gm.

Mordant; wash, and dye in separate bath of

Madder 6.0 gms.

No. 10076.

Dye with Madder alone at 80°C., using

Madder 6.00 gms.

In the second batch no Sumach was used; all samples were treated in a bran-bath for 5 minutes at 70° C. to brighten and fix; used distilled water and Chalk.

ORCHIL (CUDBEAR).

Neutral bath.

Acid bath with H₂SO₄.

Alkaline bath with soap solution.

ANATTO.

Dye at 50° C., with soap for pale shades.

Dye at 80°–100° C., without addition, for dark shades.

No. 1 (10233).

Dye 2.00 gms.

Add soap; dye at 50° C. (use soap solution).

No. 2 (10234).

Dye 4.00 gms.

Same as above.

No. 3 (10235).

Dye 6.00 gms.

No soap.

No. 4 (10236).

Dye 8.00 gms.

No soap.

WELD.

Old gold.—No. 1 (10248).

K₂Cr₂O₇ 0.2 gm.

Mordant; wash, and dye in separate bath

Weld	.	.	.	.	.	6.0	gms.
Chalk	.	.	.	.	.	0.3	gm.

No. 2 (10250).

$\text{Al}_2(\text{SO}_4)_3$	.	.	.	.	.	0.4	gm.
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Mordant; wash, and dye in separate bath with

Weld	.	.	.	.	.	7.5	gms.
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1 hour at 80° – 90° C.

No. 3.

SnCl_2	.	.	.	.	.	0.8	gm.
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Mordant; wash, and dye in separate bath

Weld	.	.	.	.	.	7.5	gms.
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No. 4 (10249).

Same, with

CuSO_4	.	.	.	.	.	0.6	gm.
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Chalk	.	.	.	.	.	0.8	"
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No. 5.

Same, with

FeSO_4	.	.	.	.	.	0.4	gm.
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Tartar	.	.	.	.	.	0.3	"
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Old Gold.

$\text{K}_2\text{Cr}_2\text{O}_7$	.	.	.	.	.	0.2	gm.
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Mordant and dye in separate bath with 0.6 gm. Weld; add 3.0 gms. Chalk to dye-bath.

Yellow.—Mordant 1–2 hours with 0.4 gm. $\text{Al}_2(\text{SO}_4)_3$; wash, and dye in separate bath with decoction of 5.0–10.00 gms. Weld for 20–60 minutes at 80° – 90° C.

Prepare bath just before dyeing; chop the Weld, put in bags, and boil in soft water $\frac{1}{2}$ –1 hour; add 0.4 gm. Chalk before dyeing.

Brighter yellows are obtained by mordanting with 0.8 gm. SnCl_2 .

Also, single bath similar to cochineal scarlet gives bright yellows.

Yellowish-olive.—Mordant with 0.6 gm. CuSO_4 ; add 0.2–0.8 gm. CaCO_3 or 0.4 gm. FeSO_4 and 0.3 gm. Tartar, with Chalk.

FUSTIC.

Use water-bath.

No. 1 (10169, 10170).

$\text{K}_2\text{Cr}_2\text{O}_7$	.	.	.	.	.	0.4	gm.
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Boil 1–1 $\frac{1}{2}$ hours; dye in separate bath at 100° C., 20–80 per cent. Wood.

This will yield a brownish or olive-yellow.

Yellow.—No. 2 (10171, 10172) (single bath).

$\text{Al}_2(\text{SO}_4)_3$		0.4 gm.
$\text{H}_2\text{C}_2\text{O}_4$		0.2 "
Wood		2-4 gms.

Dye 1-1½ hours at 80°-100° C.

The addition of Tartar deepens, but dulls the color.

Yellow.—No. 3 (10173, 10174, 10175).

$\text{Al}_2(\text{SO}_4)_3$		0.8 gm.
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Mordant 1-1½ hours at 100° C. and wash; dye-bath, 2-4 gms. Wood; work in this for ½-¾ hour at 80°-90° C.

By using 0.2-0.3 gm. SnCl_2 crystals with the alum, much brighter colors can be obtained. (See No. 4.)

Yellow.—No. 4 (10176, 10177, 10178).

$\text{Al}_2(\text{SO}_4)_3$		0.8 gm.
SnCl_2		0.3 "

Enter into bath at 50° C., heat gradually to 100° for 1-1½ hours, and dye as in No. 3.

Yellow.—No. 5 (10179, 10180).

SnCl_2		0.8 gm.
Tartar		0.8 "

Treat 1-1½ hours at 100° C., wash, and dye in a bath of Wood 3-4 gms. treating 30-40 minutes at 80°-100° C.

Yellow.—No. 6 (10181) (single bath).

Wood		4.00 gms.
SnCl_2		0.8 gm.
Tartar		0.4 "
Oxalic Acid		0.2 "

Avoid prolonged dyeing, especially at 100° C., as the tannin injures the colors; to avoid this trouble use solution of glue to extent of 4-8 per cent. of the dye-wood.

Olives.—No. 7 (10182) (single bath).

CuSO_4		0.6 gm.
Tartar		0.4 "
Wood		4.0 "

Or omit Tartar.

No. 8 (10183).

Mordant and dye, using same bath.

No. 9 (10184, 10185).

FeSO_4		0.8 gm.
Tartar		0.3 "

Mordant and dye.

No. 10 (10186, 10187) (single bath).

Use no Tartar.

Brownish or olive-yellow.—No. 1.

$K_2Cr_2O_7$ 0.400 gm.

Boil 1–1½ hours and dye in separate bath 1–1½ hours at 100° C.,
2.0–8.0 gms. dye.

Yellow.—No. 2 (single bath).

1–1½ hours at 80°–100° C.

$Al_2(SO_4)_3$ 0.4 gm.

$H_2C_2O_4$ 0.2 "

Wood 2.0–4.0 gms.

The addition of Tartar deepens, but dulls color.

No. 3.

Mordant 1–1½ hours with 0.8 gm. $Al_2(SO_4)_3$, wash, and dye ½–¾ hour at 80°–90° C., 2.0–4.0 gms. dye.

By using 0.2–0.3 gm. $SnCl_2$ with the alum much brighter colors are obtained.

No. 3.

Mordant 1–1½ hours with 0.8 gm. $SnCl_2$ crystals and 0.8 gm. Tartar, wash, and dye in separate bath 30–40 minutes at 80°–100° C., 2.0–4.0 gms. Wood.

QUERCITRON.

Use Flavin; 1 Fl. = 16 Quer.

Canary-yellow.—No. 1 (10194, 10196).

Boil ½–¾ hour in solution of.

$SnCl_2$ 0.8 gm.

$H_2C_2O_4$ 0.4 "

Take out wool and add 0.100 gm. Flavin mixed to a paste; boil 5–10 minutes, re-enter wool, and continue to boil ½–1 hour.

Oxalic acid may be replaced by Tartar or Tartaric Acid. More $SnCl_2$ yields brighter and redder shades.

Bright orange.—No. 2 (10195, 10197).

Same as above, using

Flavin 0.8 gm.

Quercitron Bark.

Olive-yellow.—No. 3 (10198, 10199).

K_2CrO_7 0.3 gm.

Mordant 1–1½ hours, wash, and dye in separate bath

Quercitron 4.0 gms.

No. 4. Same as above; use

Quercitron 8.0 gms.

Yellow.—No. 5 (10200) (single bath).

$\text{Al}_2(\text{SO}_4)_3$ 0.4 gm.

$\text{H}_2\text{C}_2\text{O}_4$ 0.2 "

Quercitron 2.0 gms.

Dye for 1-1½ hours at 80°-100° C.

No. 6 (10201).

Mordant 1-1½ hours with 0.8 gm. $\text{Al}_2(\text{SO}_4)_3$, wash, and dye in separate bath ½-¾ hour at 80°-90° C., 4.0 gms. Bark.

No. 7 (10202).

CuSO_4 0.6 gm.

Mordant, wash, and dye in separate bath of

Quercitron 4.0 gms.

for ½-¾ hour at 80°-90° C.

Quercitron Spirits.—No. 10203.

Quercitron Bark 1.00 gm.

Tartar 0.5 "

SnCl_2 0.15 "

(Same as Lac scarlet.)

Boil 20 minutes, cool down, enter wool, and boil 1 hour.

The bark was put in a bleeding bag and soaked over night.

— SUMACH.

No. 1. *Reddish-brown*.—No. 10188.

$\text{K}_2\text{Cr}_2\text{O}_7$ 0.3 gm.

Mordant 1-1½ hours, wash, and dye in separate bath.

Sumach 4.0 gms.

Avoid too high heat and add glue solution.

Yellow.—No. 2 (10189).

SnCl_2 0.8 gm.

$\text{H}_2\text{C}_2\text{O}_4$ 0.4 "

Mordant ½-¾ hour and take out wool; add 4 gms. Sumach, boil 10 minutes, re-enter wool, and boil ½-1 hour.

No. 3 (10190).

$\text{Al}_2(\text{SO}_4)_3$ 0.8 gm.

Mordant 1-1½ hours, wash, and dye in separate bath of

Sumach 4.0 gms.

½-¾ hour at 80°-90° C.

No. 4 (10191) (single bath).

$\text{Al}_2(\text{SO}_4)_3$		0.4 gm.
$\text{H}_2\text{C}_2\text{O}_4$		0.2 "
Sumach		4.0 gms.

Dye 1-1½ hours at 80°-90° C.

No. 5 (10193).

FeSO_4		0.8 gm.
Tartar		0.3 "

Mordant, wash, and dye in separate bath of

Sumach		4.0 gms.
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for 1-1½ hours at 80°-90° C.

No. 6 (10192).

CuSO_4		0.6 gm.
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Mordant, wash, and dye in separate bath of

Sumach		4.0 gms.
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for 1-1½ hours at 80°-90° C.

PERSIAN BERRIES.

No. 1 (10214, 10215, 10216, 10217).

SnCl_2		0.4 gm.
Tartar		0.2 "
Persian Berries		1.0 "

Boil ½-¾ hour and remove wool; add berries, boil 10 minutes, and add equal bulk of cold water; remove to water-bath, enter wool, and treat 1 hour at 80°-90° C.

No. 2 (10218, 10219, 10220, 10221).

Same, using

Persian Berries		4.0 gms.
SnCl_2		0.8 gm.
Tartar		0.4 "

No. 3 (10222, 10223, 10224).

Same as No. 1; use 0.2 gm. $\text{H}_2\text{C}_2\text{O}_4$ instead of Tartar.

No. 4.

Same as No. 2; use $\text{H}_2\text{C}_2\text{O}_4$ instead of Tartar.

Yellow.—No. 5 (10212).

$\text{Al}_2(\text{SO}_4)_3$		0.8 gm.
Persian Berries		4.0 gms.

Treat as in No. 1.

No. 6 (10213).

FeSO₄ 0.4 gm.

Tartar 0.3 "

Persian Berries

Treat as in No. 1.

TURMERIC.

Yellow.—No. 1 (10084).Al₂(SO₄)₃ 0.8 gm.

Turmeric 4.0 gms.

Mordant and dye.

Olive.—No. 2 (10085).K₂Cr₂O₇ 0.3 gm.

Turmeric 4.0 gms.

Same as No. 1.

Brown.—No. 3 (10086).FeSO₄ 0.8 gm.

Turmeric 4.0 gms.

Same as No. 1.

Yellow.—No. 4 (10083).

Turmeric 4.0 gms.

Same as No. 1.

Yellow.—No. 5 (10087).SnCl₂ 0.4 gm.

Turmeric 4.0 gms.

Same as No. 1.

No. 6 (10088).

CuSO₄ 0.6 gm.

Turmeric 4.0 gms.

Same as No. 1.

BARBERRY ROOT.

No. 1 (10089) (alkaline bath).

K₂Cr₂O₇ 0.3 gm.

Mordant, wash, and dye in separate bath of

Barberry Root 5.0 gms.

No. 2 (10090).

Al₂(SO₄)₃ 0.8 gm.

Mordant, wash, and dye in separate bath of

Barberry Root 5.0 gms.

No. 3 (10093).

SnCl_2	.	.	.	.	.	.	0.8 gm.
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HCl	.	.	.	.	.	.	q. s.
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Mordant, wash, and dye in separate bath of

Barberry Root	.	.	.	.	.	5.0 gms.
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No. 4 (10091).

CuSO_4	.	.	.	.	.	.	0.6 gm.
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Mordant, wash, and dye in separate bath of

Barberry Root	.	.	.	.	.	5.0 gms.
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No. 5 (10092).

FeSO_4	.	.	.	.	.	.	0.4 gm.
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Tartar	.	.	.	.	.	.	0.3 "
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Mordant, wash, and dye in separate bath of

Barberry Root	.	.	.	.	.	5.0 gms.
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CATECHU.

No. 1 (10205).

Catechu	.	.	.	.	.	.	2.00 gms.
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Boil 1-1½ hours; sadden in separate bath of

$\text{K}_2\text{Cr}_2\text{O}_7$	.	.	.	.	.	.	0.4 gm.
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for ½ hour at 80°-100° C.

No. 2 (10206).

Same as No. 1, but sadden in bath of

CuSO_4	.	.	.	.	.	.	0.6 gm.
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No. 3 (10207).

Same as No. 1, but sadden in bath of

FeSO_4	.	.	.	.	.	.	0.4 gm.
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No. 4 (10208).

Same as No. 1, but sadden in bath of

$\text{Al}_2(\text{SO}_4)_3$	.	.	.	.	.	.	1.00 gm.
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No. 5 (10209).

Same as No. 1, but sadden in bath of

SnCl_2	.	.	.	.	.	.	0.4 gm.
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LOGWOOD.

Gray.—No. 10094.

Logwood	.	.	.	.	.	.	0.5 gm.
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Boil; then treat in separate bath of

$\text{K}_2\text{Cr}_2\text{O}_7$	.	.	.	.	.	.	0.1 gm.
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Wash well.

Purple.—No. 10095, 10099.

Mordant the wool with

SnCl ₂		0.600 gm.
Tartar		0.900 "
HCl		2 or 3 drops.

Boil for 1 hour, take out, and dye in a separate bath of

Logwood		1.5 gms.
Distilled water		q. s.

Blue.—No. 10096, 10097.

Mordant for 1-1½ hours at 100° C. in bath of

Al ₂ (SO ₄) ₃		0.4 gm.
Tartar		0.5 "

Wash well and dye in separate bath of

Chip Logwood		1.5-3.0 gms.
Chalk		0.2-0.3 gm.

for 1-1½ hours at 100° C.

Blue.—No. 10098 (using another mordant).

K ₂ Cr ₂ O ₇		0.3 gm.
H ₂ SO ₄ conc.		0.1 gm.

Same method. At the close of the operation add 0.5-1 per cent.

SnCl₂.

Brigheest blues are dyed at 90° C.

Black.—*Iron-black* No. 1.

Mordant for 1½-2 hours in bath of

FeSO ₄		0.4 gm.
CuSO ₄		0.2 "
Alum		0.2 "
Argol		1.2 gms.

Take out, wring, and let lie over night; dye 1½ hours at 100° C. in 4.0-5.0 gms. Logwood.

No. 2. Black.

Boil wool 1 hour with decoction of 4.0-5.0 gms. Logwood and 0.5-1.0 gm. Fustic, lift, and cool bath; add 0.4-0.6 gm. FeSO₄ and 0.2 gm. CuSO₄, re-enter wool, raise to 100° C. in ¾ of an hour, and boil ½ hour longer.

Black.—No. 10100.

Mordant 1-1½ hours at 100° C. in bath

K ₂ Cr ₂ O ₇		0.3 gm.
H ₂ SO ₄		0.1 "
Or, H ₂ C ₂ O ₄		0.4 "
Or, H ₂ C ₄ H ₄ O ₆		0.6 "

Wash, and dye in separate bath 1-1½ hours at 100° C. of 3.5-4.0 gms. Logwood and 0.5 gm. of old Fustic; finally pass through a warm bath of 0.5 per cent K₂Cr₂O₇, using Oxalic Acid. We can recommend this bath as giving fine results.

Black on Yarn.

Mordant in bath of

$K_2Cr_2O_7$ 0.2 gm.
 for $1\frac{1}{2}$ hours at $100^\circ C.$, drain, and dye in bath of
 Logwood Extract, $51^\circ Tw.$ 1.50 gms.
 for $2\frac{1}{2}$ hours at $100^\circ C.$, bath should be acid with Acetic Acid; allow
 to cool over night in bath, wash, and dry. Results are very good.

The dyeing with indigo on a small scale not proving successful, is omitted; the best results, however, may be obtained with the sulphite vat.

The following recipes from a practical American wool-dyer are added to this article with the hope that they may prove of value to some of the readers:—

RECIPES TO DYE WOOL BLACK.

(100 pounds clean Wool.)

No. 1.

Prepare with

Blue Vitriol ($CuSO_4$) $1\frac{1}{2}$ pounds.Copperas ($FeSO_4$) 3 pounds.

Boil wool $1\frac{1}{2}$ hours, then take out of the tub and drain; throw away this liquor.

Color with

Chip Fustic 10 pounds.

Chip Logwood 15–35 pounds.

The quantity of Logwood depends upon how intense a color is wanted.

Boil chips in a bleeding bag 2 hours before putting in the wool; boil wool in this liquor $1\frac{1}{2}$ hours, turn off steam, and let the wool remain in the liquor until it cools—2 hours or longer; then drain off the liquor.

No. 2.

Prepare with

Bichromate of Potash ($K_2Cr_2O_7$) 2 pounds.

Boil wool $1\frac{1}{2}$ hours, then take it out of the tub to drain, and throw away the liquor.

Color with

Chip Logwood 15–30 pounds.

The quantity depends upon how intense a shade is required.

Boil chips in bleeding bag 2 hours and treat wool as in recipe

No. 1.

Where there is time, permit the wool to remain in the preparation (in either recipe) 2 hours after it is boiled, and let the liquor cool before draining it off; the wool is of softer feeling than if pushed through quickly.

SCARLET LAC DYE SPIRITS.

Nitric Acid	2 parts.
Muriatic Acid	1 part.
Water	2 parts.

Slowly add 2 ounces of feathered Tin to each pound of this liquid.

If the Tin be added in too great a quantity at once, it will fire the Spirits, precipitate Oxide of Tin, and render the spirits useless. It generally takes about 2 days to make good Lac Spirits.

For 100 pounds of wool (clean):—

15 pounds of Lac Dye, 5 pounds of White Tartar, and 5 quarts (imperial) of above Spirits.

Boil solution 20 minutes, cool off a little, enter wool, and boil 1 hour; shut off steam and let it soak at least 3 hours, then rinse (if yarn, rinse in cold water; if wool, rinse in water at 100° F.).

Use more or less Lac Dye, according to shade.

COCHINEAL SCARLET.

Same as Lac Dye, with the exception that the Spirits are entirely of Muriatic Acid, with 2 ounces of Tin to each pound of acid, and the Tin may be added all at once without danger.

Use one-third less Cochineal than Lac Dye.

YELLOW (QUERCITRON).

Wool (clean)	100 pounds.
Quercitron Bark	10 pounds.
White Tartar	5 pounds.
Muriate of Tin	5 quarts.

Treat in same manner as Scarlet Lac Dye.

There is no yellow colored with Fustic nowadays, and Welds are only used on silk.

INDIGO-BLUE.

There can be no recipe given for indigo-blue that would be of any service on a small scale. The following is used in a dye-house near New York.

Put into a vat 7 by 7 feet, heated by a coil to 160° F.

Woad	500 pounds.
Indigo	30 pounds.
Madder	10 pounds.
Wheat-bran	5 pounds.

After standing 12 hours it will require from 15 to 30 quarts of sifted Caustic Lime, added gradually (about 2 quarts at a time) in the course of from 48 to 72 hours.

It will be at once seen that the success of the process depends upon the skill of the operator.

The Wool is steeped in the bath, then removed and allowed to dry in the air, washed, and dipped again; repeat until the desired shade is obtained.

NOTE.—By resolution of the Council, the next volume of the TRANSACTIONS will appear by signatures as often and as rapidly as material can be collected. The Transactions will be sent to Fellows and Members in signatures as issued, or in the completed volume at the close of the year, as each Fellow and Member may elect. Honorary Members will receive the completed volume.

The price of subscription will remain as before.

H. T. VULTÉ,
Recording Secretary, Editor of the Transactions.