

# The Leather Conservation Centre

University College Campus Boughton Green Road Northampton NN2 7AN

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## REPORT OF AGEING TESTS FOR HARMATAN LEATHER LTD

Deterioration under accelerated ageing conditions was undertaken on the nine samples supplied, also on a sample of 'Archival' and two reference samples of Mimosa and Sumac leather.

The ageing was undertaken in the same chamber as previous ageing experiments, with controlled temperature and humidity conditions; samples being hung on a slow rotating carousel (1 rpm) to give even conditions for each skin. A constant flow of the air blended with the pollutant acid gasses was passed through the chamber. The flow of the pollutant gas was accurately controlled with two mass flow controllers.

Previous investigations varied the concentrations of the pollutant gases but the conditions were finally standardised to the following:

SO<sub>2</sub> - an input concentration of 40 ppm

NO<sub>2</sub> - an input concentration of 20 ppm

With the chamber running for 12 weeks

It has been determined that if the gas concentrations are doubled, ageing time can be halved. Therefore, to save time and money the following conditions were employed:

SO<sub>2</sub> - an input concentration of 80 ppm

NO<sub>2</sub> - an input concentration of 40 ppm

Chamber temperature - 40°C

R.H.- 30%

With the chamber running for 6 weeks

Gas input concentrations were tested with a 'Crowcon' meter and Drager tubes. Samples were taken from the chamber every two weeks, therefore unpolluted, two week, four week and six weeks samples were available for testing.

The two samples of Mimosa leather and Sumac leather were produced for the original STEP research programme and have been used in the various projects as reference samples. By comparing to previous results, consistency of chamber conditions have been confirmed.

Director Ian Beaumont BA Hons

Telephone 01604 719766 Facsimile 01604 719649 E-Mail [cc@northampton.ac.uk](mailto:cc@northampton.ac.uk)

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## RESULTS

### pH

	<b>Initial</b>	<b>2 Weeks</b>	<b>4 Weeks</b>	<b>6 Weeks</b>	<b>Change</b>
1. Natural Goat	4.67	2.47	2.07	2.06	2.61
2. Natural Sheep	4.1	2.62	2.15	2.2	1.9
3. Zaragoza No Sumac (tan)	4.3	2.0	1.86	1.87	2.43
4. Zaragoza No Sumac (brown)	3.36	2.21	1.95	1.9	1.46
5. Harmatan Goat Sumac	3.14	2.21	1.88	1.74	1.4
6. Sevilla Non Sumac	4.44	2.16	1.93	1.92	2.52
7. Sevilla Sumac	4.27	2.22	1.94	1.94	2.33
8. Valencia Non Sumac	3.3	2.03	1.89	1.84	1.46
9. Valencia Sumac	4.42	2.05	1.82	1.77	2.65
Mimosa	3.15	2.05	1.94	1.76	1.39
Sumac	3.21	2.32	1.93	1.92	1.29
Arc	4.43	2.77	2.19	2.15	2.28

The drop in the sumac sample was from 3.21 to 1.92, a change of 1.29

The drop in the mimosa sample was 3.15 to 1.76, a change of 1.39

This matches the lowest pH of reference samples that have been achieved in the chamber.

With only a small number of samples, it is felt that this gives a more vigorous test. At the start of the process the skins absorb the acid gases, reducing the measured concentration in the chamber. The more skins in the chamber, the greater will be the drop in concentration.

### Shrink Temperature

	<b>Initial</b>	<b>2 Weeks</b>	<b>4 Weeks</b>	<b>6 Weeks</b>	<b>Change</b>
1. Natural Goat	74	65	50	62	12
2. Natural Sheep	69	63	64	63	6
3. Zaragoza No Sumac (tan)	76	59	55	40	36
4. Zaragoza No Sumac (brown)	100	83	58	49	51
5. Harmatan Goat Sumac	74	68	59	50	24
6. Sevilla Non Sumac	92	82	70/73	61	31
7. Sevilla Sumac	85	70	58	52	33
8. Valencia Non Sumac	100	69	56	43	57
9. Valencia Sumac	79	65	60?	Too weak	
Mimosa	75	69	59	40	35
Sumac	71	70	65	58	13
Arc	Over 100	78	69	62	38

## Resistance to Flexing BS 5131:4:2

Two samples taken; one perpendicular to backbone, other right angles to backbone (average results)

	<b>Thickness mm</b>	<b>Initial</b>	<b>2 Weeks</b>	<b>4 Weeks</b>	<b>6 Weeks</b>
1. Natural Goat	1.9	11181	3939	3109	1818
2. Natural Sheep	1.9	10055	R8565	6799	3888
3. Zaragoza No Sumac (tan)	0.96	8746	2136	14	1
4. Zaragoza No Sumac (brn)	1.08	17624	5517	510	6
5. Harmatan Goat Sumac	1.00	16914	3041	447	67
6. Sevilla Non Sumac	0.78	7671	1127	381	14
7. Sevilla Sumac	1.1	9912	1819	44	0
8. Valencia Non Sumac	0.92	13769	4179	90	5
9. Valencia Sumac	0.75	29126	1016	2	0
Mimosa	1.7	2096	1063	4	1
Sumac	1.75	5012	4022	670	480
Arc	1.1	5268	3900	3060	472

## Tensile Strength (Mpa) IUP6

	<b>Initial</b>	<b>2 Weeks</b>	<b>6 Weeks</b>	<b>% Reduction</b>
1. Natural Goat	26.4	18.8	19.2	28
2. Natural Sheep	26.1	16.5	13.9	46
3. Zaragoza No Sumac (tan)	29.9	19.9	5.4	82
4. Zaragoza No Sumac (brown)	28.0	24.1	4.9	82
5. Harmatan Goat Sumac	25.4	18.1	6.6	73
6. Sevilla Non Sumac	15.9	10.1	2.5	84
7. Sevilla Sumac	15.1	11.7	2.8	81
8. Valencia Non Sumac	28.3	14.3	2.0	49
9. Valencia Sumac	17.4	14.8	2.0	88
Mimosa	13.6	7.13	1.8	86
Sumac	15.9	13.0	11.9	25
Arc	19.0	13.3	13.5	29

**Results of Previous Tests of Harmatan Leathers from  
Table 1 Representative European Bookbinding Leathers**

	<b>Sample</b>	<b>Initial</b>	<b>4 Weeks</b>	<b>8 Weeks</b>	<b>12 Weeks</b>	<b>Change</b>
<b>Ph</b>	GB25	4.27	2.67	2.24	1.86	2.41
	GB39	3.21	2.18	1.92	1.74	1.47
	GB40	4.31	2.70	2.20	1.83	2.48
<b>Shrinkage Temperature</b>	GB25	74	66	63	58	16
	GB39	75	80	66	56	27
	GB40	105	100	91	70	35
<b>Resistance to Flexing</b>	GB25	54298	10547	1515	2583	
	GB39	335215	108555	6663	1969	
	GB40	373420	365362	44819	1109	
						<b>Reduction</b>
<b>Tensile Strength</b>	GB25	23	23	19	15	35%
	GB39	21			9	57%
	GB40	19			11	42%

Raw Materials:	Six raw slaughtered large calf/veal 12 -15 sq. ft. in a salted state.
Tanning Material:	Pure sumac leaf (Turkey). Dritan mimosa extract of low sulphite (Hodgson Chemicals).
General Processing Conditions:	Mild processing conditions (static or low drum speeds) to minimise looseness and drawn grain.
Preparation (% on hide wet salted weight):	Float 250 – 300% at 20°C 1/2hr. Drain and wash off in running water.
Main Soak:	Refloat 300% at 22 – 25°C. Continuous soak over 2 days with minimum mechanical action for initial 20 minutes then 20 minutes prior to draining and washing off. 1% chlorox added to control bacteria.
Flesh:	Skins fleshed mechanically In a fleshing machine. Individual weights recorded: Total wt = 76 kg.
Lime:	Float 300% water at 22 – 25°C. 1% sodium hydrosulphide + 3% lime. Ran for 20 minutes. Added: 1% sodium sulphide + 3% lime. Ran for 20 minutes. Added: 1% sodium sulphide. Ran for 30 minutes, then rested. Ran intermittently for 5 minutes per hour. Left overnight. Ran next day 15 minutes to ensure unhairing complete. Added 0.5% sodium sulphide. Ran 5 minutes in 20 minutes. Total wt = 94 kg.
Relime:	Float 300% at 20°C. Added: 5% lime. Left on overnight and ran 5 minutes per hour.
Sample:	Samples taken from skins for collagen analysis.
Delime:	1. Washed off in water at 400% float at 32°C for 15 mins. 2. Drained and repeated. 3. Float 300% at 35°C. 4. Added 1% NH <sub>4</sub> Cl for 60 minutes. pH of liquid = 9.6. cut pp 75%. 5. Added 1% NH <sub>4</sub> Cl for 60 minutes. pH of liquid = 9.3. cut pp 100%.
Bate:	1. Float 300% water at 37°C. 2. Added 1% Pancreol Bate LPB for 25 minutes.
Wash and drained:	Water at 20°C for 15 minutes.
Scud:	Hand scudded over beam and grain hosed. Left overnight in bath of water at 20°C + 0.2% antimould A5.
Pickle:	1. Float 100% water at 20°C + 5% NaCl for 5 minutes. Added 0.2% lactic acid (1:10). Run for 60 mins = pH 5.7. Allowed to rest for 60 mins. 2. Added 0.2% lactic acid (1:10). Ran for 60 mins = pH 4.9. Allowed to stand for 120 mins. Then ran for 30 mins. Total time of pickle: 195 minutes.
Drained:	
Mimosa Tannage:	1. 25% water at 20°C + 1% antimould A5 and 5% mimosa. Allowed to run for 30 minutes. 2. Added 10% mimosa. Run for 60 minutes. 3. Added final 10% mimosa and run until tannage penetrated. Final T. of 84°C. 4. Washed in 200% water at 35°C then drained & horsed up. Total mimosa added: 25%.
Sumac Tannage:	1. 70% water at 20°C 2% Na Acetate + 0.1% antimould A5. Run for 15 minutes. then 3% sumac leaf in 10% water at 35°C + 0.1% A5 mixed and allowed to cool. This then added to drum. 2. Five further additions of sumac added 10 drum.
Samm:	Excess water removed by pressing in a machine.
Set:	Skins set out by machine to achieve smooth grain.
Split at 2mm:	Band knife splitter.
Shaved at 1.6/1.7mm:	Flesh side shaved to give 1.6 - 1.7mm wet substance.
Horsed up:	
Washed off:	Water at 35°C for 60 mins.
Cleared:	Iron particles removed with: 1. 100% at 35°C plus 0.5% Oxalic acid for 30 mins. 2. 0.5% oxalic added, ran until clear.
Washed off:	Water at 35°C.
Mimosa Retannage:	100% water at 35°C + 10% mimosa for a few hours.
Sumac Retannage:	80% water at 35°C + 20% sumac mulch for a few hours.
Fat Liquor:	1. 200% water at 40°C + 3% Neatsfoot oil compound emulsion (Neatsfoot oil compound 95% oil + 5% KTU Nonionic detergent). 2. Run for 60 minutes. 3. Rest for 4 hours. 4. Run for 20 minutes.
Drained and Horsed up over 2 days:	
Sammed and Set:	
Toggled up to Air Dry:	