

MODERN INNOVATIVE DEVELOPMENTS IN LEATHER TANNING

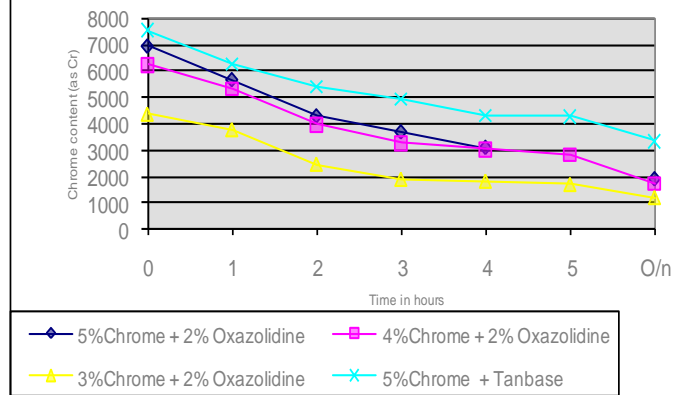
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- ⊙ Recycling the chrome exhaust in pickle,
- ⊙ Precipitate the chrome in exhaust liquor and discharge the cake in land field, or
- ⊙ Precipitate the chrome in exhaust liquor and regenerate chrome tanning agent and reusing it.

Effect of Chrome offer on Shrinkage temperature and chrome in leather and exhaust liquor

Chrome offer*, %	Chrome content in leather**, %	Shrinkage temperature, °C	Chrome in exhaust liquor, Cr(mg/l)
0	0	54	0
1	1.69	96	284.8
1.5	2.09	97	375.8
2.0	2.61	98	938.0
2.5	2.66	103	1308.7
3.0	2.91	105	1414.6
3.5	3.38	106	1443.6
4	4.03	109	1939.3
4.5	4.44	110	1962.5
5.0	4.56	111	2462.9

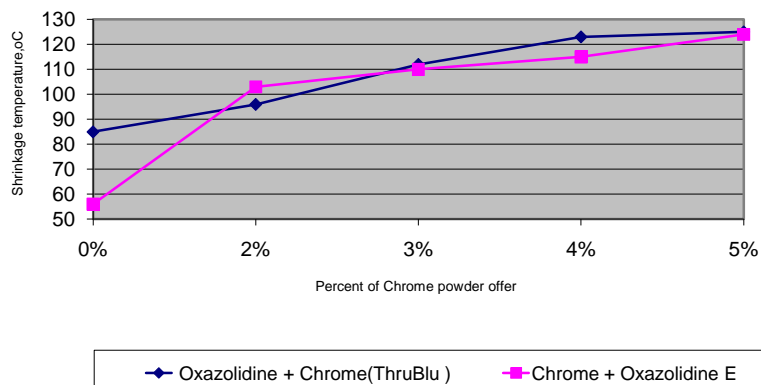
Fig 1 Effect of Chrome offer and Oxazolidine on the Residual chrome(Cr) in Exhaust liquors



Reduction of Chrome in Exhaust with Oxazolidine E

Chrome offered, %	Reduction of chrome in Exhaust, %
5	55
4	50
3	65

Fig 2 Effect of Chrome offer and tanning method on the shrinkage temperature of lambskin.



Exhaust chrome liquor from drums

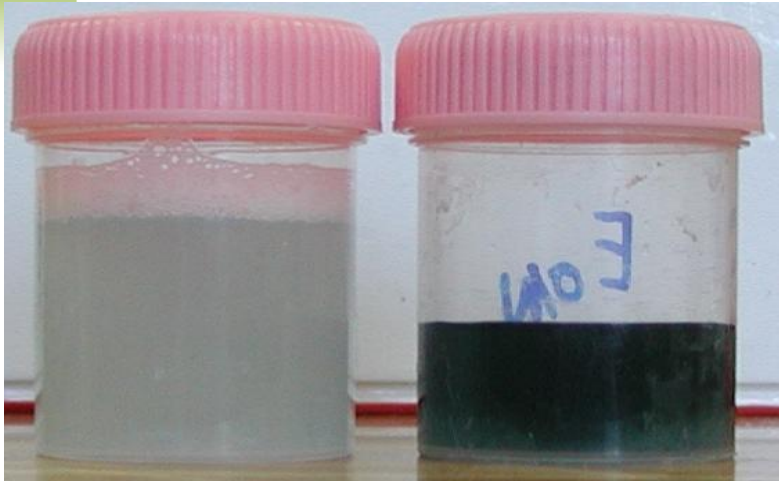
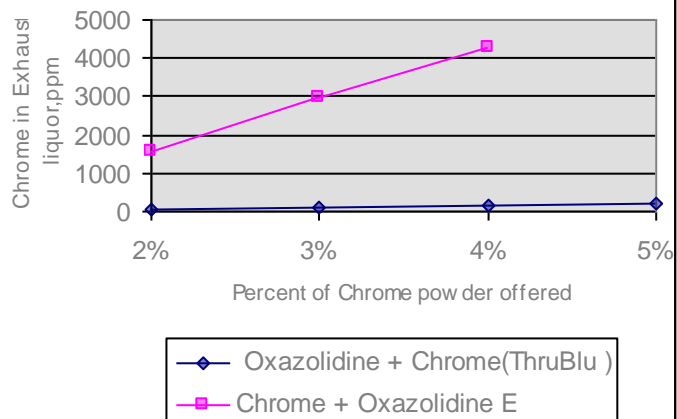


Fig 4 Effect of application technique on chrome exhaustion



Comparative properties of chrome tanned leather *

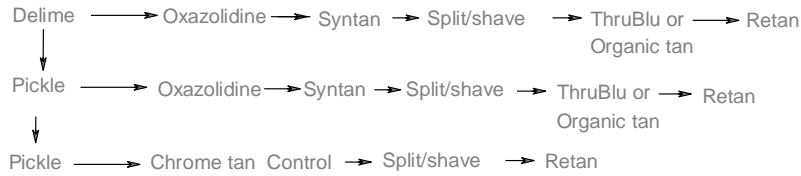
Properties	Chrome tanned with 3% chrome powder			
	System A (Oxazolidine E)		System B (THPS)	
	AVG	SD	AVG	SD
Shrinkage temperature, oC	110	-	104	-
Chrome in exhaust, ppm	60		20	
Thickness, mm	1.06a	0.19	1.16b	0.20
Tear Load, N	40.3a	5.2	40.2a	8.7
Tear strength, N/mm	42.0a	7.7	33.5b	4.2
Breaking strength, N	162.3a	25.9	162.0a	35.2
Tensile strength, N/mm ²	15.5a	2.1	14.0a	2.3
Elongation at break, %	47.1a	6.0	43.8a	4.8
Distension at grain crack, mm	8.96a	1.22	8.88a	0.46
Load at grain crack, Kg	19.9a	4.14	18.1a	3.69
Softness, BLC values	5.45a	0.68	4.77b	0.69

Exhaust liquors from chrome tanning drums

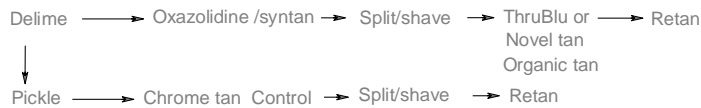




Scheme -A



Scheme -B



COMPARATIVE PHYSICAL PROPERTIES OF CHROME TANNED UPHOLSTERY LEATHER

Characteristics	Delimed stock		Pickled stock	
	Mean	SD	Mean	SD
Chrome content in leather, % (Moisture free basis)	6.0	-	5.4	-
Thickness,mm	0.90	0.06	1.07	0.08
Tear strength, N	46.9	9.9	47.9	5.4
Tear strength, N/mm	51.4	10.86	47.8	5.39
Load at grain crack, Kg	13.0	5.19	15.3	0.94
Distension at grain crack, mm	7.41	0.49	7.27	0.60
Tensile strength, N/mm ²	15.1	2.7	14.7	3.1
Elongation at break, %	54.5	10.2	63.7	7.8
Softness, BLC values	5.25	0.24	5.21	0.10

* Differences in values are not significant ($p > 0.05$)

COMPARATIVE PHYSICAL PROPERTIES OF VEGETABLE TANNED UPHOLSTERY LEATHER

Characteristics	Delimed stock		Pickle stock	
	Mean	SD	Mean	SD
Thickness,mm	1.30	0.03	1.30	0.08
Tear strength, N	41.7a	4.89	41.01a	5.4
Tear strength, N/mm	37.6a	3.9	40.9b	5.4
Load at grain crack, Kg	17.3a	3.7	18.3a	5.1
Distension at grain crack, mm	7.58a	0.04	7.99a	0.06
Breaking Load, N	187.7a	20.4	162.1a	19.3
Tensile strength, N/mm ²	16.6a	1.8	14.4b	1.1
Elongation at break, %	54.8a	3.1	48.9b	7.2
Softness, BLC values	4.00a	0.03	4.42b	0.23

* Values in rows with different letters are significant ($p < 0.05$)

Properties of upholstery Leather

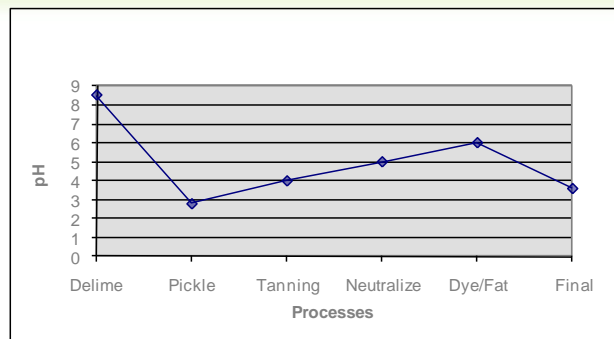
Characteristics	Chrome tanned Control		No chrome Leather	
	Mean	SD	Mean	SD
Thickness, mm	1.28a	0.02	1.38b	0.03
Grain strength:				
Load at grain crack, Kg	14.7a	1.2	18.7b	1.2
Distension at grain crack, mm	16.49a	0.93	14.88b	0.98
Tear strength, N	57.2a	3.4	40.1b	3.1
Tear strength, N/mm	46.2a	2.9	30.8b	2.7
Breaking Load, N	179.2a	17.4	142.7b	8.4
Tensile strength, N/mm ²	14.0a	1.5	10.3b	0.7
Elongation at break, %	101.0a	9.8	60.5ba	4.3
Softness, BLC values	2.80a	0.07	2.40b	0.17

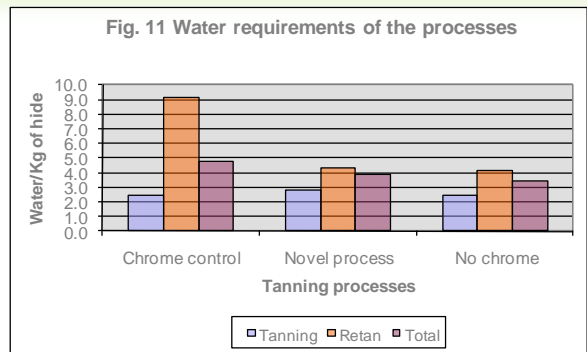
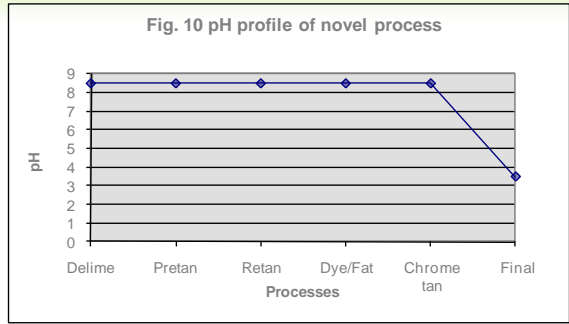
•Values in row with different letters are significant ($p < 0.05$)

COMPARATIVE DISCHARGES FROM TANNING PROCESSES

	Chrome tanned control, ppm	No chrome process, ppm	Reduction from chrome tanning, %
TKN	1093	362	66.9
SS	1175	570	51.5
COD	21559	8054	62.6
BOD5	12615	4052	67.9
Chloride(as Cl)	7316	1625	77.8
Chrome in exhaust tanning bath (as Cr)	8523	0	100.0

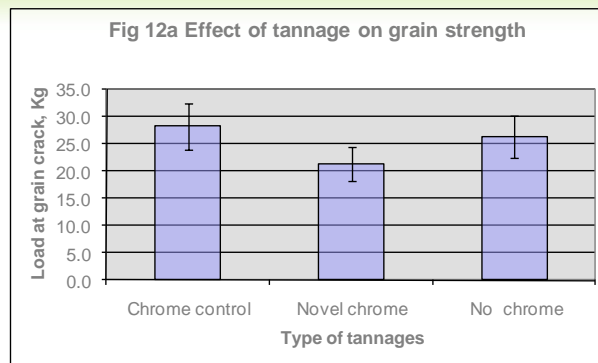
pH profile of conventional chrome tanning process

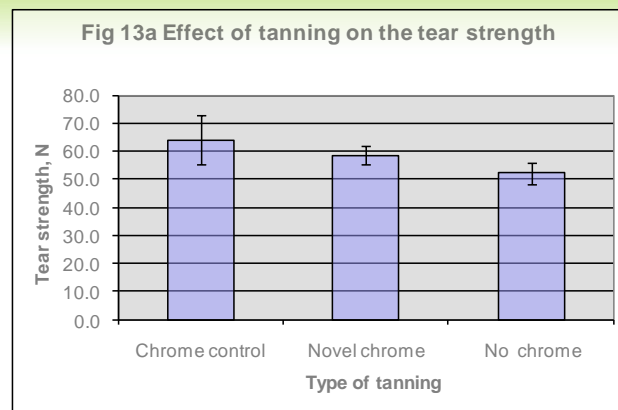
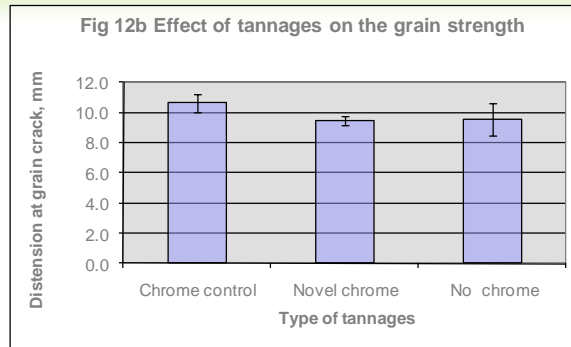


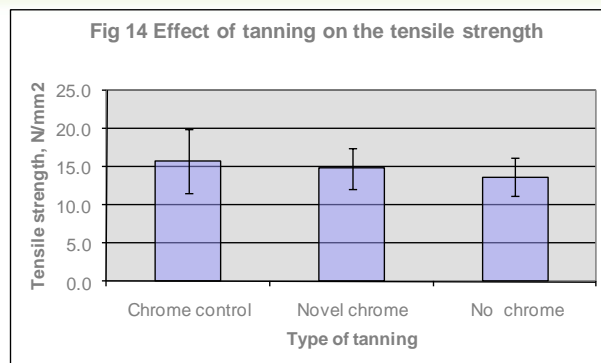
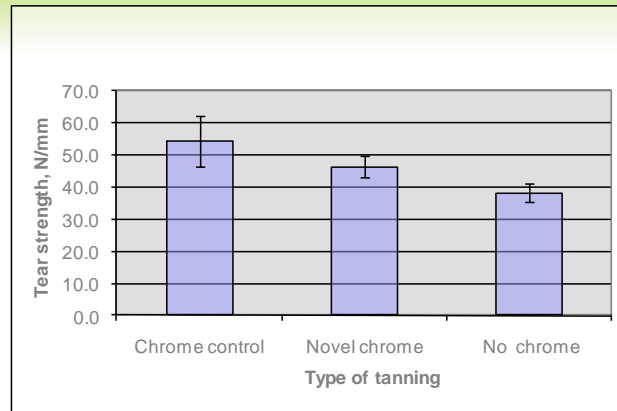


PROPERTIES OF UPHOLSTERY LEATHER

Characteristics	Chrome tanned control		Novel chrome tanned Leather		No chrome leather	
	Mean	SD	Mean	SD	Mean	SD
Thickness, mm	1.21a	0.15	1.30a	0.06	1.38b	0.21
Grain strength:						
Load at grain crack, Kg	28.3a	4.1	21.3b	3.0	26.3a	3.7
Distension at grain crack, mm	10.64a	0.58	9.47b	0.29	9.59ab	1.01
Tear strength, N	64.0a	10.57	58.5a	3.90	58.5a	3.90
Tear strength, N/mm	54.3a	9.44	46.5a	4.06	38.2b	3.49
Tensile strength, N	190.3a	56.4	191.0a	42.3	178.8a	30.4
Tensile strength, N/mm ²	15.8a	5.0	14.9a	3.2	13.7a	3.0
Elongation at break, %	87.2a	9.2	65.6b	14.0	50.9c	4.4
Softness, BLC values	3.6a	0.3	3.2a	0.3	2.8b	0.3

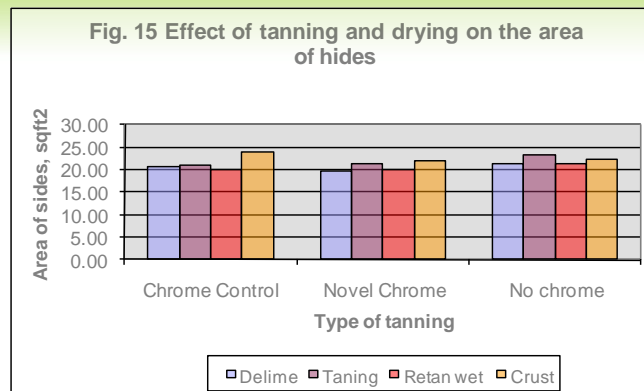






Effect of tanning and drying on the area of leather

Type of tannage	Area in sq ft ² after						
	Delime	Tanning	% of delime	Retan wet	% of delime	Crust	% of delime
Chrome control	20.8	21.2	101.8	20.1	96.5	23.9	114.9
Novel chrome	19.6	21.3	109.1	20.1	102.6	22.0	112.1
No chrome	21.3	23.2	109.0	21.2	99.9	22.5	105.8



Properties of upholstery Leather

Characteristics	Chrome tanned control		Novel chrome tanned leather	
	Mean	SD	Mean	SD
Thickness, mm	1.07a	0.08	0.90a	0.06
Grain strength:				
Load at grain crack, Kg	15.3a	0.9	13.0a	5.2
Distension at grain crack, mm	7.27a	0.60	7.41a	0.49
Tear strength, N	47.8a	5.4	47.0a	9.9
Tear strength, N/mm	47.8a	5.39	51.4b	10.8
Tensile strength, N/mm ²	14.7a	3.1	15.1b	2.7
Elongation at break, %	63.7a	7.8	54.5a	10.2
Softness, BLC values	5.21a	0.10	5.25a	0.24

Comparative discharges from tanning processes

	Chrome tanned control, ppm	Novel process, ppm	Reduction of Novel chrome process from chrome tanning, %
TKN	1000	342	65.8
SS	755	417	44.8
COD	28441	18885	33.6
BOD ₅	14293	11452	19.9
Sodium salt (as Na)	19742	13952	29.3
Chrome in exhaust tanning bath (as Cr)	5650	36	99.4

Conclusion

Lamb skins

5.1 Chrome tanning may be optimized with chrome offer of 3% for lambskins and 5% for hide tannages

5.2 A novel process for chrome tanning of lambskins has been developed by which chrome in exhaust tanning bath can be reduced to around 20-60 ppm

Hide leather

5.3 A novel approach to chrome tanning has been suggested where chrome in exhaust liquor (as Cr) was only 35ppm against 1500ppm for conventional chrome tanning.

5.4 As the processes are compacted and number of steps reduced, energy requirements for running the processes also reduced.

5.5 A process in combination of oxazolidine and mimosa without acid/salt pickling and without chrome for upholstery leather was suggested