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16166

DP/ID/SER.A/810
28 April 1986
ENGLISH

LEATHER TECHNOLOGY CENTRE

DP/CPR/83/004/11-52

CHINA

Technical report: Mimosa-Al chrome-free tannage technique

Prepared for the Government of China
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of L. Moucka, consultant
in tanning technology

Backstopping officer: J. Buljan, Agro-based Industries Branch

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Vienna

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Explanatory notes

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ABSTRACT

A consultant in tanning technology was sent to Shanghai from 17 February to 10 March 1986, as part of the ongoing project "Leather Technology Centre" (DP/CPR/83/004), by the United Nations Industrial Development Organization (UNIDO), acting as executing agency of the United Nations Development Programme (UNDP).

The consultant carried out technical trials at the pilot plant of the Shanghai Leather Research Institute (SLRI), which were co-ordinated by the Director of the Institute who is also the National Project Director. Visits to two tanneries took place during the final week of the mission.

The purpose of the consultant's mission was to carry out practical tanning demonstrations using the Mimosa-Al tannage, which gives boil-proof leather from locally available raw materials, to produce internationally acceptable export quality leather.

The trials showed that the chrome-free Mimosa-Al tannage produces very good results on all pig, sheep and goatskins available in China. Technically, all leathers were soft and of full feel and good substance. The grain selection of some pig and sheepskins, however, prevented them from being used for quality aniline or glazed leather owing to the presence of scratches or putrefaction damage. The best results were obtained with goatskins.

SLRI is now equipped with modern leather-making machines, which are being used effectively. The RIAT pneumatic glazing machine is particularly valuable. Some of the other machines were found to be either too small or too large, or not in a condition or positioned in the most suitable place to give the best results.

A complete set of formulations and the contents of the lectures were given to the staff of the SLRI.

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INTRODUCTION

A consultant in tanning technology was sent to Shanghai from 17 February to 10 March 1986, as part of the ongoing project "Leather Technology Centre" (DP/CPR/83/004), by the United Nations Industrial Development Organization (UNIDO), acting as executing agency of the United Nations Development Programme (UNDP).

The main raw materials available in China are pigskins, goatskins and sheepskins, and some buffalo hides. The number of skins produced each year is large, although there is some variation in the values obtained from statistical data assembled by different agencies. There are numerous tanneries producing various types of leathers from these materials. Shanghai is one of several leather-making centres.

It is a long-term objective of the Government of China to improve the quality of the country's leather and leather goods so that they can be exported to earn foreign currency. To aid this objective, the Shanghai Leather Research Institute (SLRI) was established with funds from UNDP. SLRI is now equipped with imported leather-making machinery. Its pilot plant could easily produce 200 skins daily if financing and sales outlets were available.

It would be more advantageous to China's economy to export fashionable leather or leather goods of high quality rather than follow the practice of many developing countries and export raw, wet-blue leather or low-quality goods.

There are several good quality chemicals available, such as dyestuffs, fat-liquors and vegetable tanning extracts. Pine-bark extract, Yu-Gan, Yan Mei and Chinese galls are locally produced vegetable extracts that are available in quantity. The Yu-Gan extract is also exported.

The objectives of the consultant's mission were to advise and lecture, with demonstrations, on modern methods of vegetable tanning for the production of export-quality articles. Particular emphasis was placed on the Mimosa-Al process, which produces boil-proof leather with a full, soft feel without effluent problems, since it uses only naturally occurring substances and no chromium compounds.

The tanning demonstrations were to be carried out at the SLRI on pigskins, goatskins and any other raw materials freely available in China, as required. A suitable programme was devised, the National Project Director was contacted to provide the skins in the required state for the trials, and arrangements were made for chemicals to be delivered from abroad to the SLRI.

The consultant was to provide formulations to the SLRI that would enable its staff to continue with the Mimosa-Al tannage on an industrial basis. He was also to visit vegetable tanneries, assess the tanning methods used and recommend improvements or help to solve any technical problems.

RECOMMENDATIONS

To the Shanghai Leather Research Institute

1. Three of the four Dosemat machines installed are large enough to process over 100 pigskins and 200 goatskins. It would be advantageous if the machines were connected to hot and cold water supplies that could be fed directly into them through the mixing tub. It should also be possible for thermostatic control as with the small Dosemat.

2. The Mercier sammying machine is very suitable for small skins, but has a tendency to produce creases at the edges of the skins, which could not be removed by setting out on the large Mercier machine. It appears that the existing equipment is not completely suitable for processing either small skins or larger hides. A larger sammying machine is required, with reversible action, and a smaller setting out machine, preferably with heated rollers.

3. The small goatskins were dried on the demonstration Incoma vacuum drier, but the SLRI would profit greatly if a full-size drier was installed.

4. The RIAT 0102 glazing machine was used for glazing all the aniline-type leathers and gave very good results. The temporary wiring should be made more secure and the machine moved from its present position to one where there is less dust blowing through the unglazed windows. The leather glazing strap should be turned over or replaced as the present one is slightly damaged.

5. All leathers that are to be glazed should be buffed on the flesh side to prevent the impressions of the flesh fibres from appearing on the grain.

6. The handspraying booth has a very good exhaust and is suitable for hides that have to be toggled on in a vertical position for spraying. For spraying smaller skins by hand it is much better to arrange for the spraying to be done in a nearly horizontal position. A few spare leather washers for the spray-gun cup would prevent leakage of the solution and spotting of the skins. Such washers could actually be made at the SLRI.

7. The Cartigliani vibration staking machine is more suitable for larger pigskins or hides. It does not soften the edges of smaller skins and a good Slokomb machine or even a staking wheel would be more preferable.

8. The toggle frame drier is very well constructed but should be connected to a heating arrangement, which is particularly necessary in the cold winter months. On the other hand, drying of soft gloving and clothing type skins should be done at low temperature to obtain the maximum softness. Some of the leathers dried in the Forni Varese drying unit at 40 °C were not as soft as those dried at room temperature overnight.

9. The consultant took his own portable pH meter on the mission but unfortunately it was damaged in transit and it was thus not possible to measure pH in coloured floats. The pH papers are only suitable for slightly coloured liquors and the Institute would profit significantly if a small portable pH meter were to be acquired.

10. The consultant feels that the SLRI is fairly well equipped with leather-making machinery and that it is capable of carrying out pilot-plant-type production.

To the tanneries visited

11. The present methods of production are considered satisfactory by local standards, although it could be more economical to tan bellies and shoulders separately from the thick compact croupons.

12. For better exhaustion of the tanning liquor and fixation it is always good practice to add some acid. The consultant was told that the pH at the end of the tannage is 3.6, which is low enough. Good exhaustion, however, depends not only on pH but also on total acid present. From the appearance of the dried leather, it was observed that oxidation of the tannin took place on the surface, which is usually a sign of insufficient fixation. The leather was hung up in the tannery and it appeared that it was only allowed to drain. A sammying machine process to remove excess moisture before drying would speed up the process and reduce oxidation of the tannin.

13. It is always advisable to use lime in the liming process for vegetable tannage to open up the fibre structure. The pigskins in the Yi Ming tannery were limed only with sulphide solution, the reason given being that only slaked lime is available in China, which is not a very suitable material for everyday work.

FINDINGS

A. Practical tanning trials

On arrival at the SLRI, the consultant was shown the skins prepared for the trials. There were 60 pickled pigskins, 30 pickled goatskins from the Xin Yi tannery for shoe upper leather, 30 pickled goatskins provided by the Yiau Xing Tannery (Shang Dong province) for garment leather, 20 small goatskins (about 0.5 ft^2) in a dry raw state to be processed into fur skins with Mimosa-Al tannage, and 10 dried wool sheepskins for garment leather.

After discussions with the National Project Director, it was decided to process the skins into the most suitable types of leather.

The goatskins were the highest quality raw materials provided for the trials. They are also the most expensive raw material and in demand abroad. The grain selection was very good, but some were only 1.5-2 ft^2 in area. The average size was about 3 ft^2.

The goatskins designated for shoe upper leather were processed into grain glazed shoe upper leather or resin-finished grain leather. Skins with poor grain were crusted and trials made to test their suitability for suede shoe upper leather.

The goatskins for garment leather were first crusted in the natural mimosa light colour, sorted and then dyed for grain garment or gloving leather.

The small goatskins were resoaked, pickled and tanned with Mimosa-Al tannage into fur skins, which could later be either used with the natural hair colour or dyed with suitable fur dyestuffs. The goatskins designated for suede shoe upper leather had to be sent to a tannery for buffing.

The quality of wool sheepskins was very disappointing. They showed much bacterial damage, probably due to the slow and insufficiently prompt method of conservation. Several of them had holes throughout the substance. Those few that were in relatively good condition would successfully make garment leather, but a resin finish would have to be used with some pigment to fill in the low grain damage. The feel, however, was very good.

The dried sheepskins were de-woolled, limed, pickled and tanned, using the Mimosa-Al process for sheep garment leathers.

The Mimosa-Al tannage gave very good results; there was no problem with grease since vegetable tannins absorb it and also cover the minor grain damage. The hair pores were also less pronounced than if chrome tanned. The best result was obtained using a glazed aniline finish. It is a straightforward calculation from the area of the skin to determine exactly how much tannage would be required on average to produce shoes, costume belts and various types of leather goods profitably. Certainly they would all be of fashionable export standard.

The various types of skins were processed as agreed and were preserved for reference purposes.

The pigskins were very damaged on the grain but were of good, plump substance. The pigskins were made into crust leather, from which they could be sorted according to their suitability for smooth grain finishes or embossed finishes for glazed or pigment-covered types of leather.

It was decided not to process any pigskins into suede leather, because this is a luxury fashionable article and not in demand at present; also, the SLRI is not equipped with buffing facilities.

B. Lectures delivered at the Shanghai Leather Research Institute

Several formal and informal lectures were delivered to 25 participants and members of the staff of the SLRI, who copied the various formulations for processing the leather into Chinese. At the end of the course, all the participants achieved high scores on a written examination and received a certificate from the SLRI. The lectures given covered the following subjects:

(a) Mimosa-Al tannage (the English version of this lecture appears in annex V);

(b) The development of the leather industry between 1935 and 1985. In this impromptu lecture, an attempt was made to inform the participants about changes in practices, the shift of the leather industry from industrialized to developing countries, and the switch from the exportation of raw skins and hides to the production of modern types of leather goods for local use and export;

(c) The comparative tanning characteristics of some vegetable tannins. Two lectures were given on tanning characteristics and the effects of salts, acid tans and non-tans on the resulting leather;

(d) Modern methods of vegetable tanning processes. The development of vegetable pit tannage, pit and drum tannages, drum tannages, rapid drum tannages, the sulphate impregnation technique, and the control of tannages and improvements that can be obtained by simple controls, were explained and described.

C. Visits to tanneries

Two tanneries in Shanghai were visited, both of which produce vegetable tanned leather. During the visits, the consultant was accompanied by Ms. Cao Xuan Hui, engineer in charge of the pilot plant at the SLRI and an interpreter.

1. Yi Ming Tannery

Two representatives of the tannery, Ms. Chen, Director, and Mr. Liu, technician, conducted the tour around the tannery and explained the processes and the types of leather produced. The vegetable sole leather plant was seen, which produces not only pigskin sole leather, but also good quality corrected chrome shoe sides (from USA wet blue).

The tannery is large, employing 700 operators, with a daily output of 1,000 pigskins. The pigskins are first limed with sodium sulphide in drums. After fleshing, they are delimed and tanned for vegetable sole leather in concrete-type mixers capable of taking up to 3.5 tons of fleshed skins, using 30% tanning extract powder on fleshed weight for 48 hours.

Two vegetable tanning extracts of local origin are used: the pine extract from the bark of trees that grow in Inner Mongolia; and the yan mey extract from the bark of a tree producing a fruit called strawberries, which are, however, not edible.

After the tannage, the leather is washed and bleached with sodium bisulphite, oiled up and treated with formaldehyde to fix the tannins. It is then piled up for several days and hung up in the tannery to dry out without further processing. As the leather is rather wet, it takes quite a long time for it to dry. During this drying period, the vegetable tannins are oxidized and the leather becomes dark brown, though still quite pleasant.

The dried pigskin leather is then conditioned by brushing with water, rolled using a pendulum roller, redried and rolled a second time. It is used for shoe soles and belts; the thinner flanks can be used for some leather goods.

2. Hu Guang Tannery

The visitors were shown around the tannery by Mr. Le Guo Ping and three of his associates. The tannery employs 170 operators, with a daily output of 300 pigskins and 120 dried buffalo hides. The buffalo hides are used for machinery belts by tanning with a chrome-vegetable combination: yar mey and cold soluble imported Quebracho extract. Some low quality hides are made into industrial gloving leathers. The pigskins are tanned into vegetable sole leather.

The production set-up in the tannery is quite unusual. The pelts are limed in mixers (10) using sodium sulphide alone for the buffalo hides and a mixture of sulphide and slaked lime for the pigskins. There are two splitting machines and the tannage is done in drums, correctly designed for vegetable tanning.

Annex I

NATIONAL STAFF COUNTERPARTS AT THE SHANGHAI LEATHER RESEARCH INSTITUTE

Shi Xiang Lin, Director of SLRI, national project director

Cheng Sheng Wei, Director of SLRI

Cao Xuan Hui, Vice-Director of SLRI and engineer in charge of the pilot plant

Wei Ching Yuan, technical adviser and senior engineer

Peng Shang Zhi, interpreter, member of the Economic and Technical Co-operation Department

Annex II

TANNERIES OF THE SHANGHAI LEATHER CORPORATION

Producing sides and heavy leathers:	Yi Ming (also vegetable pig sole leather), Hu Guang (also vegetable buffalo, pig and chrome gloving leather), Dong Fang
Producing pig leather:	Hong Guang, Xing Xing
Producing goat leather:	Xing Yi, Giu Xing

Annex III

JOB DESCRIPTION

Post title:	Consultant in tanning technology
Duration:	Three weeks
Date required:	As soon as possible
Duty station:	Shanghai, with travel within the country
Purpose of project:	To complete the establishment of a well-functioning leather technology centre in Shanghai, including a laboratory/pilot plant for demonstrations and training and development/improvement of tannery processing methods
Duties:	The expert will be attached to the Ministry of Light Industry through the Shanghai Leather Corporation and will work in close co-operation with the national project director. The expert will specifically be expected to: 1. Assess the present method of vegetable tanning on the basis of information obtained from counterparts and collected during tannery visits in the Shanghai area and identify processes where major improvements could be achieved; 2. Advise and lecture, with demonstrations, on modern methods of vegetable tanning for the production of some standard articles with particular emphasis on the Mimosa-Al tannage; 3. Based on experiments carried out with raw materials regularly used in tanneries, prepare formulae adjusted to local conditions for several articles of major importance, as required; 4. The consultant will also be expected to prepare a final report setting out the findings of his mission and his recommendations to the Government on further action that might be taken.
Qualifications:	Extensive experience in the leather industry with in-depth knowledge of modern vegetable tanning methods, especially Mimosa-Al tannage
Language;	English

Annex IV

FORMULATIONS

P

Mimosa-Al pigskin tannage 1

Thirty Chinese pickled pigskins, shaved at the pickled stage
Calculations are based on a fleshed weight of 110 kg

Prepare in Dosemat		
	60% water 20 °C 8% salt (NaCl)	Dissolve 10 min
Add	pigskins, one by one, drum	20 min
Density 11° Be', pH 3.1		
Add	1% glutaraldehyde (50%)	60 min
Density 11° Be', pH 3.2		
Add	1% sodium formate	30 min
	+ 0.5% sodium bicarbonate (1:20) pH 4.5	3 x 10 min
Add	4% salt (NaCl) 2% pretanning syntan 2% sulphited fish oil	60 min
Density 14° Be', pH 4.5		
Add	7.5% Mimosa powder 0.5% sodium bisulphite	60 min
	+ 7.5% Mimosa powder	180 min

Check penetration with 5% solution of $FeCl_3$

Rinse 20 °C for 15 min

Horse up overnight

Sam, set out, shave

Sort 1.P. 20 pigskins for crust
2.P. 10 pigskins dyed

1P
Mimosa-Al pigskins for crust 1

Twenty skins of heavier substance 1.5 mm, larger size
Shaved weight 43 kg

Rinse in Dosemat at 35 °C for 10 min

Drain

Bleach	100% water 35 °C 1% oxalic acid pH 2.8	30 min

Drain, do not rinse

Al-tannage	70% water 35 °C 10% aluminium sulphate (anhydrous) 1% sodium acetate pH 3.0	60 min
Basify	0.75% magnesium oxide + 0.75% magnesium oxide pH 4.2 IST 86 °C	45 min 45 min
Rinse	Free of Al at 20-35 °C for 10 min	
Fixation	100% water 35-40 °C 2% neutralizing Syntan 1% sodium formate + 1% sodium bicarbonate (1:2) pH 5.5, stands boil for 2 min	20 min 3 x 10 min
Fat-liquor	+ 4% sulphated synthetic oil	45 min

Horse up overnight

Sam, set out, hang up to dry

Condition, stake, using vibration machine

Toggle

Trim and sort for smooth finish (glazed or plated) or embossed finish

2P

10 Mimosa-Al pigskins for grain L

Shaved weight	= 16.5 kg	
Rinse at	35–40 °C for 10 min	
Drain		
Dyeing	100% water 40 °C	
	1.8% red-brown dyestuff mix	20 min
Fat-liquor	6% sulphated synthetic oil	
	2% sulphited fish oil	40 min
Acidify	1.5% formic acid (1:10)	5 min
	0.75% oxalic acid (1:20)	25 min
	pH 2.5	
Drain, do not wash		
Retan	70% water 35 °C	
	10% aluminium sulphate (anhydrous)	
	1% sodium acetate	60 min
Basify	+ 1% magnesium oxide	60 min
	+ 1% magnesium oxide	60 min
	pH 4.5, shrinkage 96 °C	
Rinse	Free of Al at 35 °C for 10 min	
Drain		
Fix	100% water 35 °C	
	1% neutralizing Syntan	
	1% sodium formate	20 min
	+ 1% sodium bicarbonate (1:20)	3 x 10 min
	pH 5.5, stands boil for more than 2 min	
Horse up		
Sam, set out, toggle		
Sort	5 for plated finish	
	5 for glazed finish	

3P

30 pigskins for Mimosa tannage 2

Pickled

Pickle shave with particular attention to the thick butt area

Calculations are based on a fleshed weight of 110 kg

Prepare in Dosemat		
	60% water 20 °C	
	8% salt	Dissolve 30 min
Add	Pigskins singly	30 min
	pH 3.0	
Density 11° Be'		
Add	1% glutaraldehyde 50%	60 min
	+ 1% sodium formate	20 min
	+ 0.5% sodium bicarbonate (1:20)	3 x 10 min
	pH 4.5	
Pretan	4% salt (NaCl)	
	2% pretanning Syntan	60 min
	2% sulphited fish oil	
Tan	5% Mimosa powder	30 min
	0.5% sodium sulphite	
	+ 5% Mimosa	30 min
	+ 5% Mimosa	30 min
	+ 5% Mimosa	60 min
Add	50% water 35 °C	60 min

Check penetration with $FeCl_3$ solution

Add	1% formic acid (1:20)	3 x 10 min

Horse up

Sam, set out, shave

Crust as for formula 1P

4P

Hi-Al pigskins crust 2

Thirty pigskins tanned with Mimosa as for process 3P
Shaved weight 46 kg

Rinse in Dosemat at 35 °C for 10 min

Drain

Fat-liquor	100% water 35 °C	
	4% sulphated synthetic oil	40 min
	+ 1% oxalic acid (1:20)	30 min
	pH 3.0	

Drain

Tannage	70% water 35 °C	
	10% aluminium sulphate (anhydrous)	
	1% sodium acetate	60 min
Basify	+ 1% magnesium oxide	60 min
	+ 1% magnesium oxide	60 min
	pH 4.3	

Rinse at 35 °C for 10 min

Fixation	100% water 35 °C	
	2% neutralizing Syntan	
	1% sodium formate	20 min
	+ 1% sodium bicarbonate (1:20)	3 x 10 min
	pH 5.5, stands boil	

Horse up overnight

Sam, set out, hang up to dry

Condition, stake, toggle

C

30 Mimosa-Al goatskins for shoe upper leather

Calculations are based on twice the drained pickled weight = 26 kg

Prepare in Dosemat		
	60% water 20 °C 10% salt (NaCl)	Dissolve 10 min
Add	Pickled pelts separated one by one	20 min
Density 10° Be', pH 3.3		
Depickle	1% sodium formate	30 min
	+ 0.5% sodium bicarbonate	3 x 10 min
	pH 5.0	
Pretan	+ 4% salt (NaCl)	
	2% pretanning Syntan	
	2% sulphited fish oil	60 min
	pH 4.2	
Density 12° Be'		
Tannage	7.5% Mimosa powder	
	0.5% sodium sulphite	60 min
	+ 7.5% Mimosa powder	120 min
	+ 3% Mimosa powder	60 min

Check penetration with 5% solution of $FeCl_3$

Rinse at 20 °C for 10 min

Horse up overnight

Sam, set out, shave

Sort
5G 10 skins for shoe upper
6G 10 skins for suede crust

4G

Mimosa-Al shoe upper goats glazed or plated finish

Ten goats tanned as G, shaved weight 2.3 kg

Wash with water 35 °C		10 min
Dye	150% water 35 °C	
	2% brown chrome complex dye	20 min
Fat-liquor	5% sulphated synthetic oil	
	1% sulphited fish oil	40 min
Acidify	2% formic acid (1:10)	5 min
	1% oxalic acid (1:10)	20 min
	pH 2.8	
Drain, do not wash		
Al-tannage	70% water 35 °C	
	10% aluminium sulphate	
	1% sodium acetate	60 min
Basify	1% magnesium oxide	60 min
	1% magnesium oxide	60 min
	pH 4.2	
	Shrinkage 90 °C	
Rinse with water 35 °C		
Fixation	150% water 35 °C	
	1% neutralizing Syntan	
	1% sodium formate	30 min
	+ 0.6% sodium bicarbonate (1:10)	3 x 10 min
	pH 5.4, shrinkage 100 °C	

Horse up overnight

Set out, vacuum dry at 80 °C for 1 min

Condition, vibration stake

Toggle

Finish	Some glazed
	Some plated

5G

Mimosa-Al goatskins f.. shoe upper

Shaved weight 4.5 kg, substance 0.9-1.1 mm, average size 3.5 ϕ

Rinse in Dosemat in water at 35 °C for 10 min

Bleach	100% water 35 °C	
	1% oxalic acid	30 min
	pH 3.0	

Drain, do not wash

Al-tannage	70% water 35 °C	
	15% aluminium sulphate (anhydrous)	
	1.5% sodium acetate	60 min
Basify	+ 1% magnesium oxide	60 min
	+ 1% magnesium oxide	60 min
	pH 4.0, shrinkage 98 °C	

Rinse free of Al at 35 °C for 10 min

Fix	150% water 35 °C	
	2% neutralizing Syntan	
	1% sodium formate	20 min
	+ 1% sodium bicarbonate (1:20)	3 x 10 min
	pH 5.5, stands boil for over 2 min	

Drain

Dye	100% water 40 °C	
	1% brown acid dyestuff	20 min
Fat-liquor	5% sulphated synthetic oil	
	1% sulphited fish oil	40 min
Exhaust	+ 3% Mimosa powder	

Horse up overnight

Sam, set out, vacuum dry at 80 °C for 1 min

Air dry: condition, stake

Finish: glazed

Glazing finish: 2 x dye solution,
2 g/l water STAHL Chemical Industries B.V.

2 x A:
- 75 parts hard protein B1-01
- 100 parts medium hard protein B1-372
- 100 parts 5% casein solution
- 20 parts softening agent B1-1380 (wax) emulsion/oil
- 100 parts dye solution (chrome-complex in oxytol)
- 800 parts water

	2 x B:	150 parts B1-01
		100 parts B1-372
		100 parts 5% casein
		10 parts B1-1380
		800 parts water
		200 parts dye solution
Fixing	2 x	300 parts formaldehyde
		900 parts water
		3 parts silicone emulsion KS3121

Dry overnight

Plate 80 °C 100 tons, kissplate

Glaze on Riat pneumatic glazing machine at pressure of 1 atmosphere

Finiflex 100 °C

6G

Mimosa-Al crust for shoe suedes

Ten skins of poor grain selection
Shaved weight 4.1 kg

Rinse in Dosemat at 35 °C for 10 min

Drain

Bleach	100% water 35 °C	
	1% oxalic acid	30 min
	pH 2.8	

Drain, do not wash

Al-tannage	70% water 35 °C	
	15% aluminium sulphate (anhydrous)	
	1.5% sodium acetate	60 min
	pH 3.2	
Basify	+ 1% magnesium oxide	60 min
	+ 1% magnesium oxide	60 min
	pH 5.7, stands boil for 2 min	

Rinse free of Al at 35 °C for 10 min

Fixation	100% water 35 °C	
	1% sodium formate	
	1% neutralizing Syntan	30 min

Drain

Fat-liquor	100% water 45 °C	
	2% sulphated synthetic oil	
	1% sulphited fish oil	40 min

Horse up overnight

Sam, set out, dry, suspension in warm chamber

6G.B
Mimosa-Al goatskins shoe upper suedes

Skins processed by formulations G + 6G

Set out, hung dried

Conditioned by spraying water

Vibration staked (Cartigliani machine)

Toggled

Trimmed

Buffed by 380 grid paper twice

Weighed out = dry weight

Dyeing method

4. Red suedes and blue suedes

Dry weight 1000 g

Rewet in Dosemat at 35 °C	600% water	30 min
Drain		
Dyeing	600% water 40 °C	
	10% red or blue chrome-complex dyestuff	40 min
	+ 2% cationic dye fixing agent	30 min
	+ 1% formic acid (1:20)	3 x 10 min
	+ 2% cationic fat-liquoring emulsion	30 min

Horse up

Set out on flesh side

Hang up to dry

Spray condition

Vibration stake

Raise nap by brushing, trim

7S

Wool sheepskins for Mimosa-Al garment leather

Ten air-dried Chinese sheepskins, 9 with white wool, 1 with black wool

Soak I: soak overnight in water + 0.1% rewetting agent

Take out, change float

Soak II: soak for 4 hours

Break on fleshing machine

Paint with sulphide-lime paint 18° Be'

De-wool by hand

Lime in white lime for 2 days in a drum, rotate for 5 min during day every 2 hours

Flesh

Weigh out 20 kg

Into Dosemat with plenty of water (60 l)

Wash cold for 30 min

Warm up to 38 °C

Delime	300% water 38 °C 2% ammonium chloride pH 8.3	30 min
Bate	0.2% pancreatic bate	60 min
Check		
Degrease	3% nonionic degreasing agent 10% salt (NaCl)	30 min 30 min
Wash	+ 300% cold water 20 °C	10 min
Drain		
Wash	300% water 20 °C	20 min
Drain		
Pickle	100% water 20 °C 15% salt	30 min
Density 8° Be'	+ 1% sulphuric acid 1:10 diluted and cooled down, drum	120 min

Leave in drum overnight

7S

Mimosa-Al sheep garment leather

In the morning check pH 2.5

Drain, take skins out to drain for 60 min

Prepare	100% water 20 °C 15% salt		20 min
Density	8° Be'		
Add skins		Drum	20 min
	pH 3.5		
Add	2% Glutaraldehyde (50%)		60 min
	pH 3.5		
	+ 1% sodium formate		30 min
	+ 0.5% sodium bicarbonate (1:20)		3 x 10 min
	pH 4.8		
Add	4% salt 2% sulphited fish oil 3% pretanning Syntan pH 4.7		60 min
Tannage	+ 7.5% Mimosa powder		60 min
	0.5% sodium bisulphite		
	+ 7.5% Mimosa powder		120 min

Check penetration with $FeCl_3$ solution

Pile up overnight

Sort, some skins have very poor grain selection
and bacterial damage

Sam good skins, set, shave

7S

Mimosa-Al garment sheep crust

Shaved weight 6.2 kg

Wash at 35 °C for 10 min

Fat-liquor	100% water 35 °C	
	10% sulphated synthetic oil	
	6% sulphited fish oil	40 min
	0.5% emulsifying agent	
Acidify	+ 2% formic acid (1:10)	5 min
	+ 1% oxalic acid (1:20)	20 min
	pH 2.8	

Drain, do not wash

Al-tannage	70% water at 35 °C	
	10% aluminium sulphate (anhydrous)	
	1% sodium acetate	60 min
Basify	+ 1% magnesium oxide	60 min
	+ 1% magnesium oxide	60 min
	pH 4.2	

Rinse free of Al at 35 °C for 15 min

Drain

Fix	150% water at 35 °C	
	1% sodium formate	20 min
	1% neutralizing Syntan	
	+ 1% sodium bicarbonate (1:10)	3 x 10 min
	pH 5.5	

Horse up, set out, air dry out

7S

Mimosa-Al sheep garment leather

Dyeing from crust
Six pieces sheep crust
Calculations are based on a dry weight of 1860 g

Rewet	1000% water at 35 °C	30 min
Drain		
Dye	500% water at 35 °C	
	3% brown dye	60 min
	+ 2% acidic white Syntan	30 min
	+ 0.5% formic acid (1:20)	3 x 15 min
	pH 4.5	

Exhaustion reasonably good

Horse up, set out, toggle lightly to dry

8C

Mimosa-Al tannage of small goats with hair on (small kids)

Size 0.5–0.75 ft^2, substance 0.3–0.4 mm
Air-dried goats, white and grey hair
Soak in water at 20 °C with 10 g Baymola overnight

Beam by hand to remove flesh

Resoak	15 l water 20 °C 10 g soaking agent 50 g ammonia	overnight
Beam by hand		
Wash		
Pickle in container	20 l water at 20 °C 5 kg salt 200 g sulphuric acid	15° Be' pH 1
Leave in pickle for 36 hours		13° Be', pH 1.5
Pretan	10 l water at 20 °C 1.5 kg salt 400 g pretanning Syntan	overnight
Vegetable tannage: in container		
	10 l water 2 kg Mimosa powder 200 g pretanning Syntan	overnight
Transfer into Dosemat (was not available earlier)		
Rotate 4 rev/min		120 min leave overnight
Penetration complete		
Drain		
Drained weight 2.5 kg		
Rotation of Dosemat 4 rev/min		
Rinse at 35 °C for 10 min		
Acidify	200% water 35 °C 1% oxalic acid pH 2.8	30 min
Drain		
Tannage	200% water at 35 °C 20% aluminium sulphate 2% sodium acetate	60 min

Basify	+ 1% magnesium oxide	60 min
	+ 1% magnesium oxide	60 min
	pH 4.2	
Wash with 5 l water at 35 °C		5 min
Drain		
Wash with 5 l water at 35 °C		10 min
Drain		
Fix	200% water 35 °C	
	1% neutralizing Syntan	
	1% sodium formate	20 min
	1% sodium bicarbonate	3 x 5 min
		+ 15 min
	pH 5.2, stands boil for 2 min	
Fat-liquor	100% water 35 °C	
	4% sulphited fish oil	30 min

Horse up to drain overnight

Toggle wet, air-dry cold (2 days)

Take down from frames, send to owners (for factory)

For finishing (i.e. hand staking, overshot wheel buffing, dry milling)

9G

Mimosa-Al garment goatskins

Thirty pickled goatskins (Chinese origin), drained pickled weight = 10 kg
Calculations are based on reconstructed fleshed weight, drained pickled weight x 3 = 30 kg

Prepare in Dosemat		
	60% water 20 °C	Dissolve 10 min
	8% salt (NaCl)	
Add pickled pelts		
	pH 2.8 9° Be'	20 min
Pretan	2% glutaraldehyde 50%	60 min
	pH 2.9	
Add	1% sodium formate	20 min
	+ 0.5% sodium bicarbonate (1:20)	2 x 10 min
	pH 4.7	
Add	4% salt (NaCl)	
	2% pretanning Syntan	
	3% sulphited fish oil	60 min
	pH 4.5 13° Be'	
	+ 5% Mimosa powder	
	0.5% sodium bisulphite	30 min
	+ 5% Mimosa powder	30 min
	+ 5% Mimosa powder	120 min

Check penetration with $FeCl_3$ solution

Horse up, sam, set out, shave

10G

Mimosa-Al garment goat crust and dyeing

Thirty Chinese goats
Calculations are based on shaved weight

Wash at 35 °C in Dosemat		10 min
Fat-liquor	100% water 35 °C	
	10% sulphated synthetic oil	
	6% sulphited fish oil	40 min
	0.1% emulsifying agent	
	+ 1.5% formic acid (1:10)	5 min
	+ 1% oxalic acid (1:10)	20 min
	pH 2.8	
Drain, do not wash		
Al-tannage	70% water 35 °C	
	15% aluminium sulphate (anhydrous)	
	pH 3.1	60 min
	1.5% sodium acetate	
	+ 1% magnesium oxide	60 min
	+ 1% magnesium oxide	60 min
	pH 4.5	
Rinse free of Al	15 min at 35 °C	
Fix	1% sodium formate	
	0.3% neutralizing Syntan	20 min
	+ 0.75% sodium bicarbonate (1:10)	3 x 10 min
	pH 5.5	

Horse up overnight

Set out, hang up to dry, spray condition

Stake, Cartigliani vibration machine

Toggle, sort

10G/B

Mimosa-Al garment goat dyeing method from crust (10G)

Eleven dried crust goatskins, dry weight 1500 g

Rewet	500% water at 40 °C	30 min
Wash	Water 40 °C	10 min
Drain		
Dye	500% water 40 °C	
	10% Sella fast brown DR	40 min
	+ 2% Levotan K	30 min
	1% formic acid (1:20)	3 x 10 min
	2% Aminex 1624	60 min

Check pH with meter

Check exhaustion

Check boiling test

Horse up, set out lightly, dry out

Annex V

LECTURE GIVEN AT THE SHANGHAI LEATHER RESEARCH INSTITUTE ON MIMOSA-AL TANNAGE

A lot of work has been done in recent years to find an economical and safe replacement for chrome tannage. Research institutes and chemical companies throughout the world have tried various alternatives, such as aldehydes, syntans, vegetable tanning and metals such as zirconium and aluminium, and have investigated tannages using these alternatives alone or in combination with one another. The main reason for this activity is the general world-wide agreement that the presence of the element chromium in tannery effluents or as waste deposited in the ground is undesirable and dangerous.

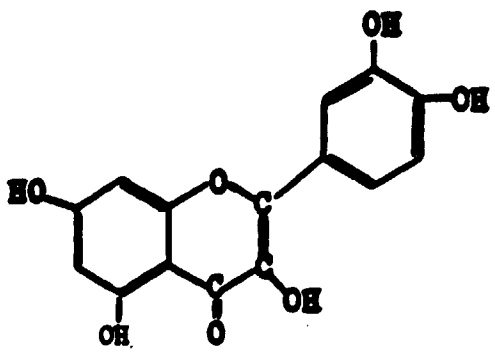
For several years, a number of research institutes have concentrated their investigations on the combination tannage between Mimosa extract and aluminium salts. Slabbert outlined the theory of this tannage in 1981. The Mimosa industry has studied its application and is constantly perfecting its use on various types of leather.

The main requirement in the use of this tannage is the thorough penetration of delimed, pickled pelts with a minimum amount of Mimosa vegetable extract followed by retannage with masked basified aluminium sulphate. The complex formation between the polymeric polyphenols and aluminium diols is completed by buffered neutralization.

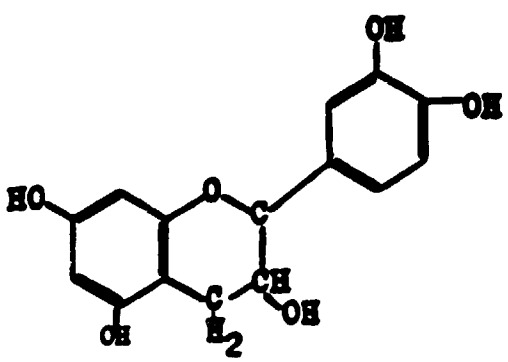
Leather produced in this way has some quite remarkable properties. It is boil-proof just like chrome tanned leather and in fact shrinkage temperatures found lie between 100 °C and 120 °C. It can be dyed, fat-liquored, set out and dried and finished just like chrome leather. Vacuum driers and plating presses can be used at similar, or even higher, temperatures to those used in the manufacture of chrome leather using the same machinery. For bovine leather, however, the tanning drum should run at a slower speed (6 rev/min), although with a float of 60% this is not necessary.

The Mimosa-Al tanned leather also has some properties that are different to those of chrome tanned leather. The leather is fireproof and gives no afterglow when subjected to strong flames. It is therefore very suitable in the form of fire blankets for fighting fires and is not as dangerous as asbestos fibre. It can be used in gloves used by firemen, and also for upholstery in cars and aeroplanes. Leather gloves, shoes and other apparel will not cause dermatitis to the wearer. Mimosa-Al tanned leather can be used in all other normal leather goods production, such as shoes, handbags, cases, garments and sheepskin covers and the possibilities for its use are constantly being evaluated.

The Mimosa extract is mainly composed of polymeric polyphenolic flavanoid molecules such as:

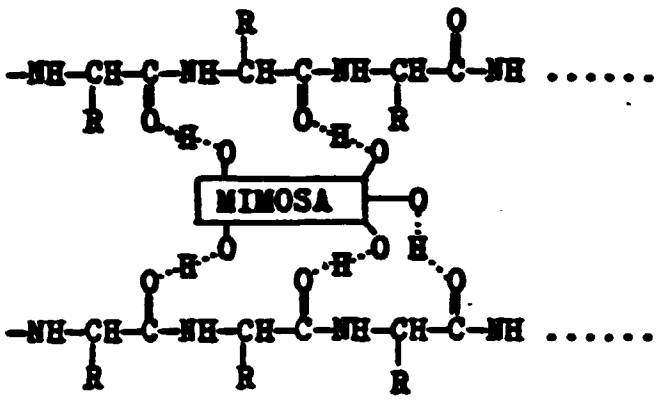


Quercetin



Cyanidin

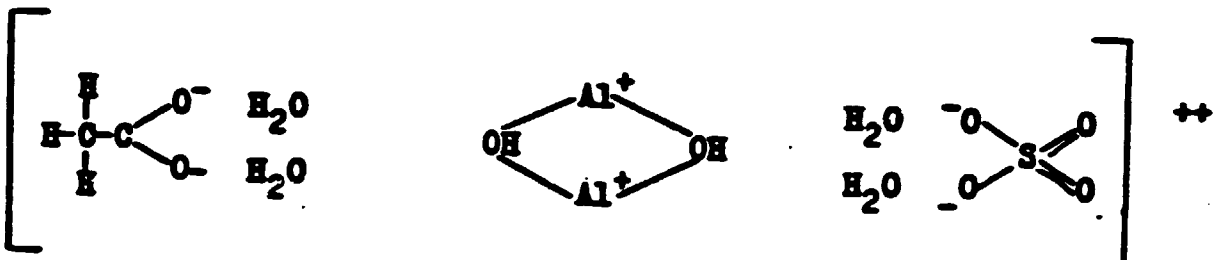
The vegetable tannage takes place by multiple hydrogen bonding between the phenolic OH (hydroxyl) groups on Mimosa and the -C=O groups of the collagen polypeptide chain:



Polypeptide chain

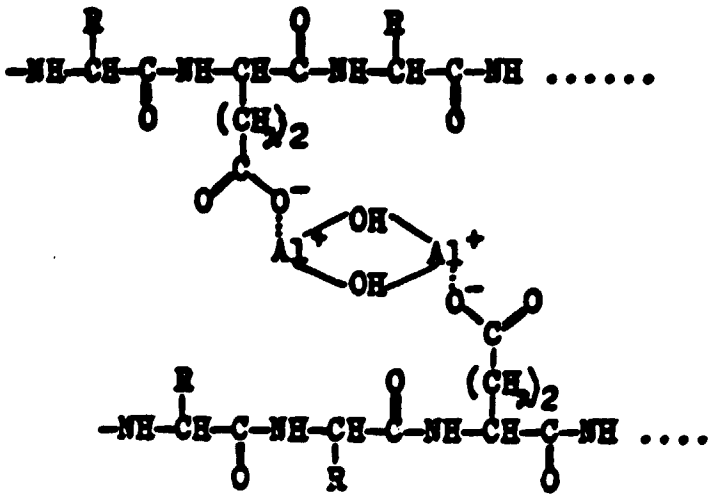
R = COOH or NH_2

When aluminium sulphate ($Al_2(SO_4)_3$) is masked with sodium acetate (CH_3COONa) and basified, its formula can be represented as follows:



Acetate Al-diol Sulphate

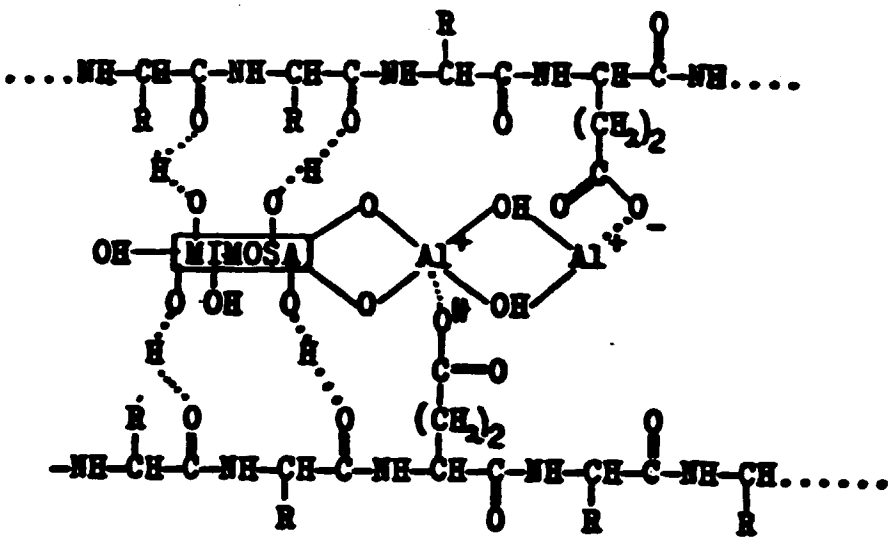
The aluminium diols hydrolyse in solution to form diol complexes fixed at higher pH levels by electrochemical bonds to the -COOH (carboxyl) groups on the collagen polypeptide side chain.



Aluminium diol

Polypeptide

When Mimosa tanned leather is treated with aluminium sulphate masked with basic acetate, the Mimosa molecule fixed to the polypeptide collagen chain interacts with the aluminium diols that are already fixed to the polypeptide chain by the electrovalent bonds. Very strong bridging occurs, which accounts for the high hydrothermal stability of Mimosa-Al tanned leather:



The theory of the process as well as its practical application require the following conditions:

(a) Complete penetration of the pelt with a minimum quantity of Mimosa extract;

(b) Complete penetration by aluminium sulphate, which occurs at pH 3-3.1;

(c) The formation of the Mimosa-Al complex throughout the substance by basification;

(d) Insolubilization of the complex between Mimosa and aluminium, by masked neutralization to complete the bridging;

(e) Prevention of reaction reversal, i.e. the pH must not be lowered by acidification after dyeing or fat-liquoring.

The application of theory to practice

The limed pelts must be well fleshed and preferably split to the minimum required substance, which is 2.5 mm for bovine leather. There are many ways to tan pelts with Mimosa. From practical experiments, however, it was found that the sulphate conditioning process gives the quickest penetration with the minimum quantity of Mimosa powder. It is possible to pre-tan the pelts with glutaraldehyde if softer leather is required. Whenever sulphate is not acceptable, sodium chloride is used.

Small quantities of syntans can also be used as pre-tanning agents, but a larger percentage prevents the bridging and complexing reactions and high shrinkage temperatures will not be reached.

After the Mimosa tannage, the leather is sammied and shaved to the required substance. The leather should contain about 55% moisture. Any iron stains should be removed at this stage, using oxalic acid and some chelating agent (e.g. ethylene diamine tetraacetic acid, EDTA). Should the leather be required through-dyed, it is best to dye at this stage for full penetration before the addition of acid. The leather must be acidified to pH 3-3.1 before the retannage with aluminium sulphate to ensure complete penetration.

The aluminium sulphate must be free of iron. The quantity recommended is 10% on the shaved weight, which is 1.8% Al_2O_3. The temperature of retannage should be 35 °C and the pH 3-3.1.

Leather tanned with Mimosa alone will retain the same pale colour after aluminium retannage. It is better to use Mimosa alone, therefore, particularly for special shades that have to be dyed.

The aluminium sulphate must be masked to prevent hydrolysis and precipitation in solution as aluminium hydroxide. The addition of 1% anhydrous sodium acetate is recommended. The basification is best done using magnesium oxide powder, which basifies slowly and gradually, removing excess free acid without producing excess alkali in solution. The bridging process takes place efficiently in the interior of the leather and not in the tanning bath. Whenever magnesium oxide is not available, it is possible to use sodium carbonate. Great care should be taken, adding the alkali slowly in many small additions as a 10% solution. The drip-feed method may be used, but the process takes much longer (over 3 hours) and requires more work and strict supervision.

When an alkali such as sodium carbonate is added to aluminium sulphate solution, soluble sodium aluminates are formed, which have no tanning action. The reaction takes place above pH 8.0 and can be represented as follows:

$$Al_2(SO_4)_3 + 3\ Na_2CO_3 = Al_2(CO_3)_3 + 3\ Na_2SO_4$$

$$Al_2(CO_3)_3 + 6\ H_2O = 2\ Al(OH)_3 + 3\ H_2CO_3$$

$$2\ Al(OH)_3 + Na_2CO_3 = 2\ NaAlO_2 + CO_2 + 3\ H_2O$$

sodium aluminate

It is recommended that a float of 70% water be used at 35 °C. The aluminium sulphate is added, followed by the sodium acetate, and the mixture is drummed for one hour and then basified. The consultant obtained excellent experimental results adding all the chemicals and magnesium oxide to the leather in the drum together in powder form and drumming for 60-90 minutes.

The shrinkage temperature after basification rises to 85-90 °C. The excess free aluminium sulphate should be removed by washing with water.

The buffered neutralization completes the complex formation and bridging between the collagen, Mimosa and aluminium. The pH should be brought to 4.8 using sodium bicarbonate. The shrinkage temperature at this stage will be over 100 °C, and the leather should be able to stand boiling water for 2 minutes. Using a mixture of water and glycerine, it was possible to reach shrinkage temperatures between 110 and 120 °C.

Various dyestuffs (e.g. acid chrome complex) can be used to produce coloured shades on the Mimosa-Al tanned leather. Deep black or brown shades may require topping with basic dyestuffs, but these may show faults on the grain of the leather. It should be pointed out that most dyestuffs complex quickly with aluminium, forming dye lakes, which tend to be reddish in cast. It is therefore recommended that each dyestuff be tested by mixing its solution with a solution of aluminium sulphate, then filtering the precipitate and noting the shade of the lake on the filter paper and the degree of lake formation in the residual liquid.

Similar precautions should be adopted with fat-liquors. Most modern commercial fat-liquors are not affected by salts or aluminium. However, some fatty acids produce greasy aluminium soaps on the surface of the leather, making it difficult to dry out and finish. It is possible to test for this problem by simply mixing the components in solution.

It is not recommended that the leather be acidified after the aluminium retannage. Lowering the pH breaks up the bridging and the leather will no longer be boil-proof. To exhaust the fat-liquor, it is quite adequate to add from 1 to 2% Mimosa powder or an acid white Syntan to the fat-liquoring bath.

Special considerations in the Mimosa-Al process for the production of soft garment leathers from pigskins

Modern methods of producing pigskin leather require faster and more economical process operations that take into account the special histological properties of pigskin:

(a) The fibre structure is different for the rather loose skin from shoulders and bellies and the very compact, dense butt area;

(b) There is a highly developed elastic sheath network around the bristle follicles below the grain membrane and also the muscles belonging to the bristles;

(c) The bristles themselves are very deeply set and actually puncture the skin;

(d) The subcutaneous connective tissue is a layer of fat of varying thickness in the form of fat cells 2-3 mm wide and deep, which penetrate into the corium, which in turn contains the bristle roots.

Owing to these special histological features of pigskins, the liming process has to be longer and stronger. It is also necessary to use the reliming method, after removing the bristles, and a suspension of white lime to saponify the fats and split up further the compact collagen structure of the butt area.

The butt area requires an intensive liming action. This is because the short fibre and its compact structure and the large proportion of elastic fibres and bristle muscles are relatively resistant to alkali treatment.

The liming process should be done in two stages. In the first treatment, using sodium sulphide, the fibres are quickly swollen, the fat saponified and the bristles loosened. The second part is a reliming process, using mainly hydrated lime, to open up the fibre structure. This type of double liming will level up and open up the fibre structure, ensuring a uniform, soft leather handle all over the skin.

It is also possible to use the "paint in drum" method. Only 30 per cent total float with sodium sulphide is used to remove the bristles. The short float and high sulphide concentration will not allow the collagen to swell but the alkali will penetrate very quickly. The grain is clean and the dyeing properties are improved. After about two hours, some 300 per cent water is added to increase the float and to obtain the necessary swelling of the collagen.

The total liming time is about two days. Even so, this is rather a short period of time and a more prolonged, strong bating process is required to open up the fibre structure further. The pancreatic enzyme will act mainly on the elastic fibre network.

The bating process should be done in a water float at 35–38 °C and pH 8.3–8.5. The pH can be tested using phenolphthalein indicator, which should show a pale pink colour.

Because of the fatty nature of pigskin it is necessary to remove any surface fat tissues on the flesh side mechanically with a fleshing machine or by hand.

It is also necessary to apply surface-active non-ionic degreasing agents during the process of soaking, liming, reliming and bating, and to use a separate degreasing process after the bating.

The advantage of the vegetable tannage using Mimosa extract is its ability to disperse and absorb large quantities of fatty matter, which makes it particularly suitable as a tanning material for pigskins.

A pretannage with glutaraldehyde will produce leather with a softer feel. Glutaraldehyde penetrates quickly at pH 2.8–3.3, which is the pH of the pickle liquor. The combination of the amino groups of collagen with the aldehyde groups takes place at pH 4.5–5. The tannage is completed by adding an alkali to raise the pH to this level.

This pH range, which is also very suitable for the penetration of Mimosa extract, is called the isoelectric point of collagen. It represents the pH at which the amino and carboxyl groups of the protein chains are in their undissociated state and thus not reactive enough to combine with the vegetable tannin. Hence the tannin has a good chance of penetrating through the fibre structure, before combination takes place.

The presence of sodium sulphate in the pickle bath and the addition of further amounts before the vegetable tannage also reduces the interaction between collagen and the tannin and hence helps the penetration of the tannin. The addition of pretanning Syntan helps the level of distribution of the tannin: the Syntan combines first with the grain layer of the skin and thus prevents rapid tannage on the surface, which may later cause so-called cracky grain.

The presence of anionic fat-liquor before vegetable tannage lubricates the grain, reduces friction in the tanning drum and imparts extra softness to the leather.

The addition of sodium bisulphite (Metabisulphite) has two actions. It removes excess glutaraldehyde by forming a bisulphite combination with the carbonyl group. It also prevents any oxidation of vegetable tannin and helps the penetration of the tannin.

Retannage with aluminium sulphate produces leather that is able to withstand boiling water and is therefore equivalent in this respect to chrome-tanned leather.

The pigskin leather tanned in this way can be used for many purposes:

(a) Suede garment leather;

(b) Suede or grain gloving leather;

(c) Lining leather (using the lower selection skin);

(d) Case leather (embossed or glazed);

(e) Good selection grain pigskins can be made into nubuck leather by buffing the grain;

(f) Imitation embossed snake or lizard leather for handbags, shoes, belts etc.

Mimosa-Al pigskin leathers

Raw material: Fresh or salted pigskins
Calculations are based on a salted or fresh weight
It is an advantage to green flesh the skins to remove excess fat

	In a drum, paddle or mixer	
Rinse	Full float of water at 20-30 °C	15 min
Drain		
Soak	400% water at 20-30 °C 0.2% soda ash 0.2% nonionic detergent	4-6 hours
Rinse	Full float at 20-30 °C	10 min
Remove bristle if required		
Liming	Slow rotating drum (1-2 rev/min) or a pit or paddle 150% water in drum 400% in paddle 4.5% sodium sulphide 60% sodium sulphide 2% hydrated lime ($Ca(OH)_2$)	8-15 hours
Drain		
Wash	Full float at 20-30 °C	15 min
Split	Butt 1.5 mm, belly 2.2 mm	
Weigh out		
Reliming	In drum 150% water at 20-30 °C In paddle 400% water at 20-30 °C 6% hydrated lime 0.5-1% dimethyl amine sulphate	16-24 hours
Reuse when possible for successive packs		
Wash	Water at 30-35 °C	
Deliming	150% water at 35 °C 2% ammonium chloride 0.5% sodium bisulphite ($NaHSO_3$)	30 min 60 min
Check	pH 8.3 - pink to phenolphthalein	
Bate	1-1.5% pacreatic bate (1500 TU)	90 min
Drain		
Degrease	2-3% nonionic degreasing agent	45 min
Add	300% water at 30 °C	30 min

Wash	**Water (cold) at 20 °C**	**15 min**
Drain		
Pickle	**40–60% water at 20 °C** **10% salt (NaCl or Na_2SO_4) (anhydrous)**	**30 min**
Check density is over 6° Be'		
	0.7–1% sulphuric acid (1:10)	**30 min**
	0.3% formic acid (1:20)	**2 hours**
Leave overnight in the drum		
	pH in the morning 2.8–3.3, 6–9° Be'	
Either (A):		
Pile up		
Pickle, flesh		
Weigh out: calculate pickled weight x 1.5–2.0		
This is to convert to fleshed weight		
Then prepare	**60% water at 20 °C** **10% salt (NaCl or Na_2SO_4) (anhydrous)**	**30 min**
Add pickled pelt		
Or (B):		
Continue in the pickle bath as above		
Calculations on fleshed weight		
Add	**2–3% modified glutaraldehyde**	**60 min**
Add	**1.0% sodium formate (or calcium formate)**	**30 min**
Add	**1–1.5% sodium bicarbonate (3 x 10)** **pH 4.5–5.0**	
Drain		
Add	**6% salt (NaCl or Na_2SO_4)** **2% sulphited fat-liquor** **2% pretanning Syntan**	**60 min**
Check density is over 14° Be'		
Add	**7.5% Mimosa powder**	
Add	**0.5% sodium bisulphite**	**30 min**
Add	**7.5% Mimosa**	**2 hours**
Add	**50% water at 35 °C**	**2–3 hours**

Check penetration with ferric chloride ($FeCl_3$) solution, particularly in the butt area

If penetration complete:
wash to remove excess salts — 15 min

Pile up, sam, shave to required substance

Weigh out	Chemical calculations based on shaved weight	
Wash	Water at 35 °C	10 min
Dye	100% water at 35 °C x% dyestuff to shade	

Fat-liquor

<u>For case, shoe upper, belt leather</u>

	6-8% suitable fat-liquor	20 min

<u>For garment leather</u>

	15-20% suitable fat-liquor	30 min
Fix	2-3% formic acid (1:10) 1% oxalic acid	2 x 5 min 20 min

Check exhaustion

Check pH below 3.0

Drain

Al-tannage	70% water at 35 °C 10% aluminium sulphate (iron free) 1% sodium acetate	1 hour
Basify	1-2% magnesium oxide (tanbase)	2 x 30 min

Add, if necessary

	1% sodium bicarbonate (1:20) pH to be over 3.8	3 x 10 min

Wash to remove excess aluminium sulphate 35 °C — 10 min

Drain

Fixation	150% water at 35 °C 1% neutralizing agent 1% sodium or calcium formate	20 min
Add	1% sodium bicarbonate (1:20) pH to be over 4.8-5.5	3 x 10 min

Check shrinkage temperature - should stand boil for over 2 min

Horse up overnight, sam, set out

Dry by hanging or vacuum or toggling or pasting

Condition, stake, toggle, trim, finish

Garment leather to be suspension dried

Conditioned

Staked

Dry drummed **12-18 hours**

Toggle lightly, finish, stake or dry drum

Mimosa-Al goatskin leather for shoe upper leather

The skins should be soaked, limed, fleshed, delimed, bated and pickled as a standard procedure

Calculations are based on reconstructed limed, fleshed weight i.e. drained, pickled weight x factor (1.5-2.0)

Prepare in tanning drum	60% water 10% salt (NaCl or Na_2SO_4)	
Drum to dissolve		10 min
Add pickled pelts, drum		10 min
For soft leather		
Add	2% modified glutaraldehyde	1 hour
For normal leather, it is not necessary to use glutaraldehyde		
Add	1% sodium formate	30 min
Add	1% sodium bicarbonate (1:20) pH 4.5-5.0	3 x 10 min
Add	2% sulphited anionic fat-liquor 2-4% pretanning Syntan 6% salt (NaCl or Na_2SO_4) (anhydrous)	1 hour
Check density is over 14° Be'		
Add	7.5% Mimosa powder 7.5% Mimosa powder	30 min 2 hours
Check penetration with ferric chloride ($FeCl_3$) solution		
Drum till completely penetrated		
Wash with water at 30 °C to remove salt		10 min
Pile up, sam, shave to substance, weigh out		
Calculation on shaved weight		
Wash	Water at 35 °C	10 min
Dye	150% water at 35 °C x% dyestuff to shade	20 min
Fat-liquor	4-6% anionic suitable fat-liquor 0.5% oxalic acid	20 min 10 min
Acidify	2% formic acid (1:10) 1% oxalic acid pH to be below 3.0	3 x 10 min
Drain		

Al-retannage	70% water at 35 °C 10% aluminium sulphate 1% sodium acetate	1 hour
Basify	Add 1-2% magnesium oxide	2 x 30 min
If necessary, add	1% sodium bicarbonate pH to be over 3.8	3 x 10 min
Wash excess aluminium with water at 35 °C		10 min
Drain		
Fixation	150% water at 35 °C 1% neutralizing Syntan 1% sodium formate	20 min
Add	1.5% sodium bicarbonate (1:20 pH to be over 4.8	3 x 10 min

Boiling test: to stand over 2 min boil at 100 °C

Horse up overnight, sam, set out

Dry out - vacuum, suspension, toggle, paste

Condition, stake, toggle, trim, finish

Mimosa-Al goatskin for garment leather

Soak		
Lime as usual		
Flesh		
Weigh out		
Relime	100% water 6% white slaked lime	18-24 hours
Take out, the lime can be reused		
Wash cold		
Warm to 38 °C		
Delime	150% water at 38 °C 2% ammonium sulphate pH 8.3, pink to phenolphthalein	1 hour
Bate	1-1.5% bate (1,500 UT)	1 1/2-2 hours
Drain		
Cool by washing with cold water		
Drain		
Pickle	60% water (cold) 10% salt 0.7-1% sulphuric acid (1:10) + 0.3% formic acid (1:10)	 30 min 2 hours
Leave in drum overnight	pH 2.8-3.3	
Either horse up for sorting, or continue in the same bath		
Add	3% modified glutaraldehyde	1 hour
Add	1% sodium formate	30 min
Add	1% sodium bicarbonate (1:20) pH 4.5-5	3 x 10 min
Add	6% salt (NaCl or Na_2SO_4) (anhydrous) 2% pretanning Syntan 2% sulphited fat-liquor	 1 hour
Check density is over 14° Be'		
Tannage:		
Add	7.5% Mimosa powder	30 min
Add	7.5% Mimosa powder	2 hours

Check penetration with ferric chloride ($FeCl_3$) solution

Drum till penetrated

Wash	Water at 30 °C	10 min

Pile up, sam, set out

Shave to substance required

Weigh out: calculations on shaved weight

Wash	Water at 35 °C	10 min
Dye	150% water at 35 °C x% dyestuff to shade	20 min
Fat-liquor	15% suitable anionic fat-liquor	20 min
	0.5% oxalic acid	10 min
Acidify	2% formic acid (1:10) pH 3.0	3 x 10 min

Drain

Al-tannage	70% water at 35 °C 10% aluminium sulphate 1% sodium acetate	1 hour
Add	1% magnesium oxide	30 min
Add	1% sodium carbonate (1:10)	3 x 10 min
Wash excess aluminium with water at 35 °C		10 min

Drain

Fixation	150% water at 35 °C 1% neutralizing Syntan 1% sodium formate	20 min
	1.5% sodium bicarbonate (1:20) pH to be over 4.8	3 x 10 min

Boiling test: to stand 2 min boil at 100 °C

Pile up overnight to drain

Set out, hang up to dry, condition, stake

Dry drum (milling) till soft 6-12 hours

Toggle, trim, finish, stake