A MORE SUSTAINABLE CHROME TANNING PROCESS WITH HIGH CHROME EXHAUSTION

O. PERDRIX, E. HERVY, F. BOUTILLIER, L. SALINAS, Q. DA SILVA, B. RENARD
ATC TANNERY CHEMICALS, 193 ALLÉE DE LA CROIX DES HORMES, 69250 MONTANAY, FRANCE

TANNERY CHEMICALS
ISO 9001 ISO 14001

Currently, the leather industry faces very challenging task because of the regulations enforced by the several pollution control agencies to maintain the discharged norms of the chemicals in the treated water. Chrome tanning is one of the most polluting processes due to the presence of Cr(III) in the wastewaters. This problem can be solved by high-exhaustion chrome tanning technology. In this study, an acrylic/dicarboxylic acid copolymer was used as a tanning auxiliary (TA). This approach introduces more binding sites with carboxyl groups onto collagen fibers, significantly enhances chromium fixation and reduces chromium discharges in wastewater. The best results are 90% chrome exhaustion using 4% of TA and 4% of chromium sulfate. The properties of leather obtained with this new technology were compared with traditionnal tanning. Physical tests as the shrinkage temperature, tensile strenght and tear strenght were carried out. The results showed no effect on thermal stability and on mechanical properties with the amounts used of chromium sulftate and TA.

Keywords : Chrome tanning, Chrome exhaustion, Tanning auxiliary, Tanning wastewater

MATERIALS & METHODS

Materials

Tanning trials were carried out using cow hides (3-4 mm) and goat skins (1mm). Basic Chromium Sulphate (CS) of 33% basicity was used as a chrome tan.

Methods

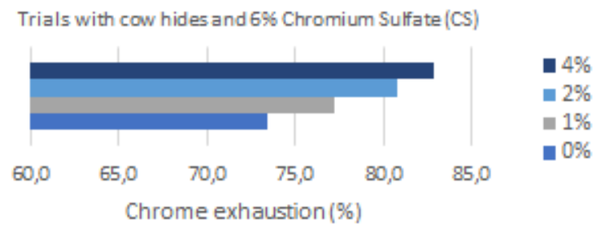
TANNING	New process (%)	Traditionnal (%)	
Brine	70	70	Rotate -10'
CS	6	6	Rotate-4h
TA	1, 2 or 4	/	Rotate-90'
Soda formate	1	1	Rotate 60'
Basifying agent	1	1	Rotate-14h
			T=35°C / pH=3,9

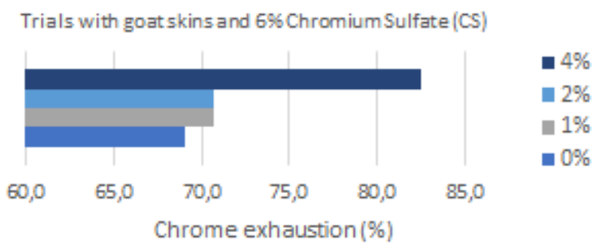
Chrome exhaustion was determinated by ICP-AES following the methods NF EN ISO 11885 and NF EN ISO 15587-2.

Physicals tests on leather were carried out according the following standardized methods :
*Measurement of tensile strength and percentage elongation : ISO 3376
*Measurement of tear load : ISO 3377-1
*Measurement of shrinkage temperature up to 100°C : ISO 3380

HIGH CHROME EXHAUSTION TANNING SYSTEM : 6% OF CHROMIUM SULFATE

Chromium content in tanning wastewater



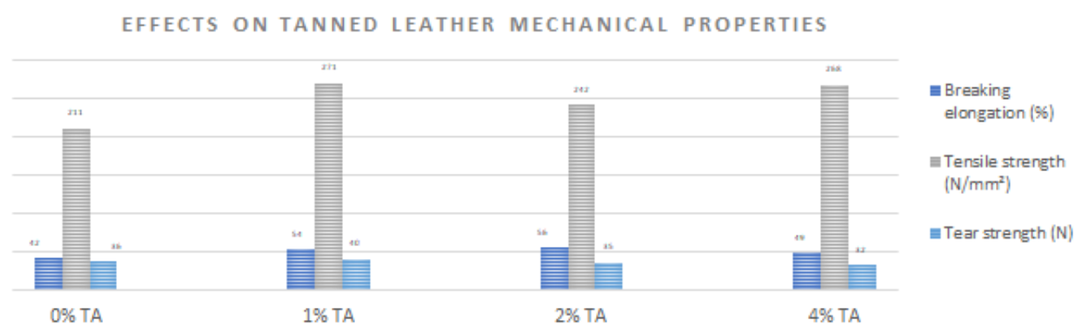


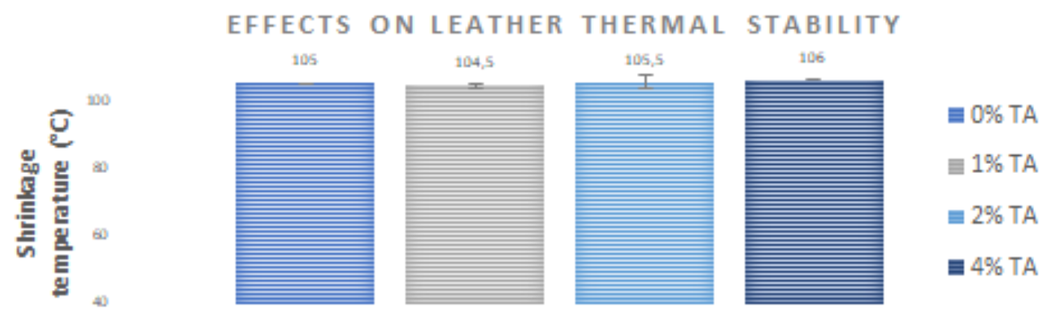
Chrome exhaustion with traditional tanning is around 70%. The same results are found in literature as well with 6% CS [1] as with 8% CS [2].

Improvement of chrome exhaustion using the tanning auxiliary, an acrylic/dicarboxylic acid copolymer, because of increasing the number of carboxyl groups onto collagen fibers.

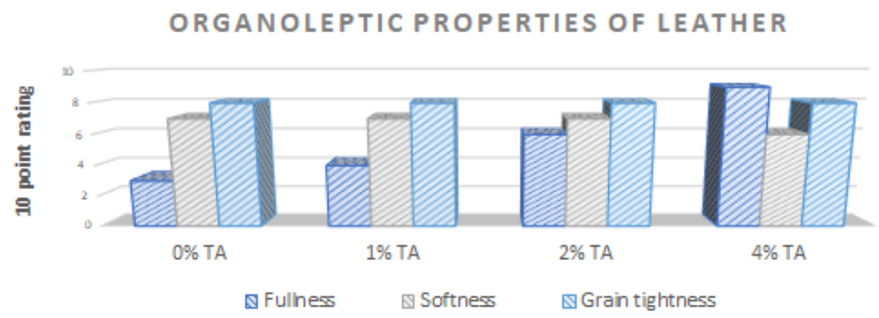
Dose dependent effect up to 4%

Similar results on cow hides and goat skins



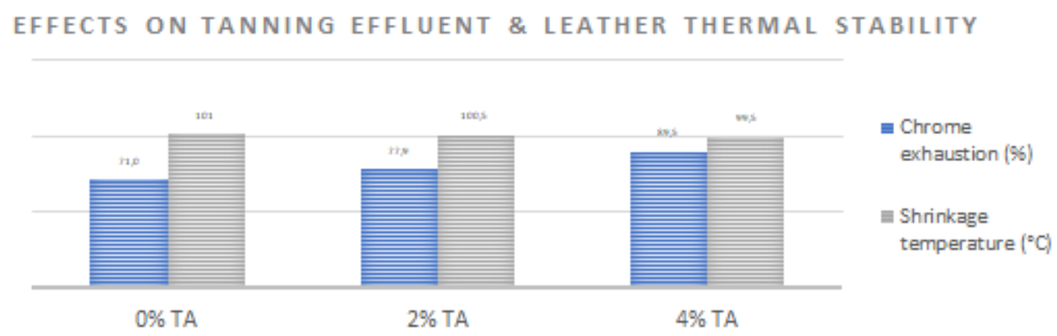


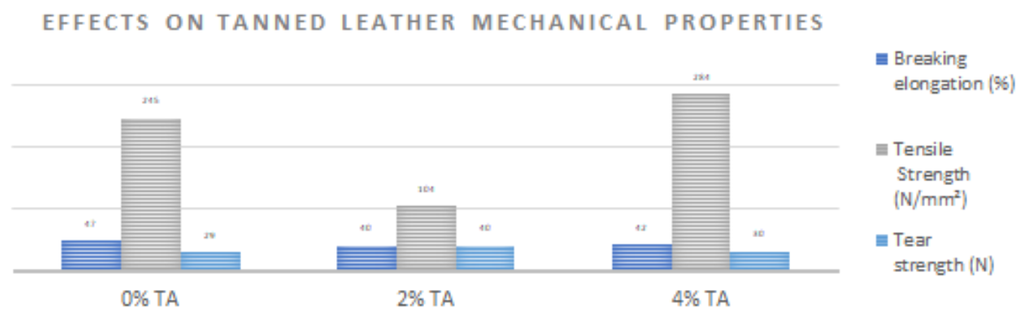
Increasing chrome fixation on leather has no effect on shrinkage temperature and on mechanical properties with the amounts used of chromium sulfate and tanning auxiliary.



Improvement of fullness
Slight decrease of softness
No effect on the grain tightness

CHROME-LESS TANNING SYSTEM : 4% OF CHROMIUM SULFATE





Traditional tanning process with 4% CS leads to the same results than with 6% CS as regards the chrome exhaustion (≈70%).
The trials realized with 2% and 4% of tanning auxiliary (TA) show the similar or even better results to those obtained with 6% of CS. (≈90% chrome exhaustion with 4% TA)

The leather thermal stability is slightly affected by reducing CS concentration but the shrinkage temperature is always satisfactory for chrome tanning process. No statistically significant effect of TA is observed on the shrinkage temperature.

No effect on mechanicals properties by decreasing the CS concentration whether with or without the addition of TA.

CONCLUSION & PERSPECTIVES

TA enhances the chrome fixation on leather because of increasing the number of carboxylic groups. The best results obtained are 90% chrome exhaustion using 4% of chromium sulphate and 4% of TA. In addition to being a high chrome exhaustion system, it is also a chrome-less tanning system. No effect was observed on the shrinkage temperature and on mechanicals properties using the TA. Reducing the initial amount of CS resulted in a decrease of shrinkage temperature which however remains satisfactory for a chrome tanning process.

Further research would be necessary to optimize this eco-friendly leather tanning process.

REFERENCES

[1] R. Zhu *et al.*, A smart high chrome exhaustion and chrome-less tanning system based on chromium (III)-loaded nanoparticles for cleaner leather processing, J. of cleaner Prod 277, 12327, 2020
[2] J. Kanagaraj *et al.*, High exhaust chrome tanning using novel copolymer for eco-friendly leather processing, JALCA, VOL 103, 2008

Responsible Care®
LEATHER WORKING GROUP
COMPLIANT · COMPLIANT · REACH