# OXIDATIVE REDUCTIVE LIMING

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**ABSTRACT**

Purpose of the study: development of a liming process with low environmental impact, and mainly low percentage of sulphide and COD in wastewater.
The process puts together traditional technologies with innovative technologies.
It involves part of the traditional system of liming and a new generation of oxidative system, it is also supported by a preparation of soaking and liming with enzymes and enzyme activators.
With this process it is possible to perform both hair recovery lime and destructive lime, with a potential further reduction of COD in wastewater.
This liming process can be completed between 24/48 hours and can be used on many types of raw hides. It is simple and completely safe for workers.
The aim of this study is not only an eco-sustainable liming, but also to produce high quality hides with a low environmental impact, overcoming the limits of oxidative liming that, notoriously, reduces quality of finished product.
This study aims to be a solution for the production of high-quality hides (that can be compares to hides made with traditional liming process) with a sustainable and safe for workers process.

*Keywords: sustainable liming, safe application, technical innovation, versatility*

## 1. Introduction

Purpose of the study: creation of a low environmental impact liming with low percentage of sulphide and COD in the wastewater.

We followed three main principles developing the process:

1. Environmental sustainability: traditional liming is one of the most polluting stages of leather production process and it is necessary to find an alternative solution. As a matter of fact, in our process we sensibly reduced sulphide-based products in the reductive liming part, and used non- dangerous products in the oxidative liming part.
2. Technical innovation: beginning from one traditional liming process and one new process with many risks, we studied a combined application of the two processes, notably reducing the risks during application.
3. Flexible application: the developed process can be done in every kind of drum. Moreover this type of liming enables to choose between hair-pulping and hair recovery. Furthermore the hides made with this kind of liming can be used for any kind of tanning.

## 2. Material and Methods

Oxidative-reductive liming is organized in three stages:

1 – Enzyme soaking: realized using a mix of enzymes with lipase, amylase and probiotics with degreasing, wetting agents and saponifying agents.

2 – Reductive liming: First step: Unhairing enzymes with organic reducing agents. Later on: Hydrated lime. And at the end: Inorganic reductive agents

3 – Oxidative liming: Alkalization (hair recovery is possible at this stage), mixture of oxidating agent and activator of oxidation, final addition of hydrate lime.

**Initial stage:** we made preparatory trials in the little laboratory drums to create the first structure of the process. These trials enabled us to focus on the most critical points of the process such as: soaking, first stage of traditional liming and second stage of oxidative liming. At this stage we performed around 10 trials with 2 kg of raw salted hide.

**Second stage:** Trials in standard laboratory drum. We worked on 3 hides in each drum (ca 40 kg) with the system previously developed. After the liming we tanned the leathers with different methods (white tanning, chrome tanning) and after we retanned leathers in many different articles to check the flexibility of the process.

**Third stage:** Trials in the tannery drum. Our first trial has been made with 30 hides in a medium drum and a second trial has been done with other 40 hides in R&D drum.

## 3. Results and Discussion

Leathers resulting from this process, once that they are tanned and retanned, have a great quality, structure, grain distension, roundness and fullness.

The research process focused on two problems: the matter of temperature increase during the oxidative liming, and the excess of usage of sulphur salts that creates a big quantity of mud due to the fact that, in the traditional liming system, sulphur salts must be added in excess as the function of it is around 60/70%, consequently creating a pollution load and increasing costs (considering also the recent lack of sodium sulphide and sodium sulphydrate in the market).

As a matter of fact, the innovative combination system of reductive liming and oxidative liming requires a usage of less than 1% of liquid sodium solphydrate.

With regards to the problem of temperature increase of the reductive liming we found out the system for keeping the temperature under control. We kept the values of the temperature around 30-31°C in the crucial phase of the process balancing the water used during addition of chemical products, but not increasing the usual quantity of water used for traditional liming.

We had satisfying results regarding environmental impact thanks to the reduction of mud produced by the process and also for the COD values that are kept under 30.000 ppm.

Quality of the recovered hair is good; hair is dry and transferable.

The leather is well-stretched, with a good cutting area and an intact grain. Color of the slat is uniform, the structure of the slat is turgid even in the flabby parts of the side and the head.

Water consumption is within the average, for this process we used usual number of floats: 2 de-salting floats, 1 soak, 1 liming float with a precise water addition together with chemicals and auxiliaries.

## 4. Conclusion

Environmental sustainability is achieved through following points:

- We work with enzymes that do not degrease so do not create COD, they digest the fatty substances keeping the COD at low levels.
- Limited quantity of sulphur.

- During winter, thanks to the control of the liming temperature, it will be possible to use water not excessively heated, with a subsequent saving of gas and energy.

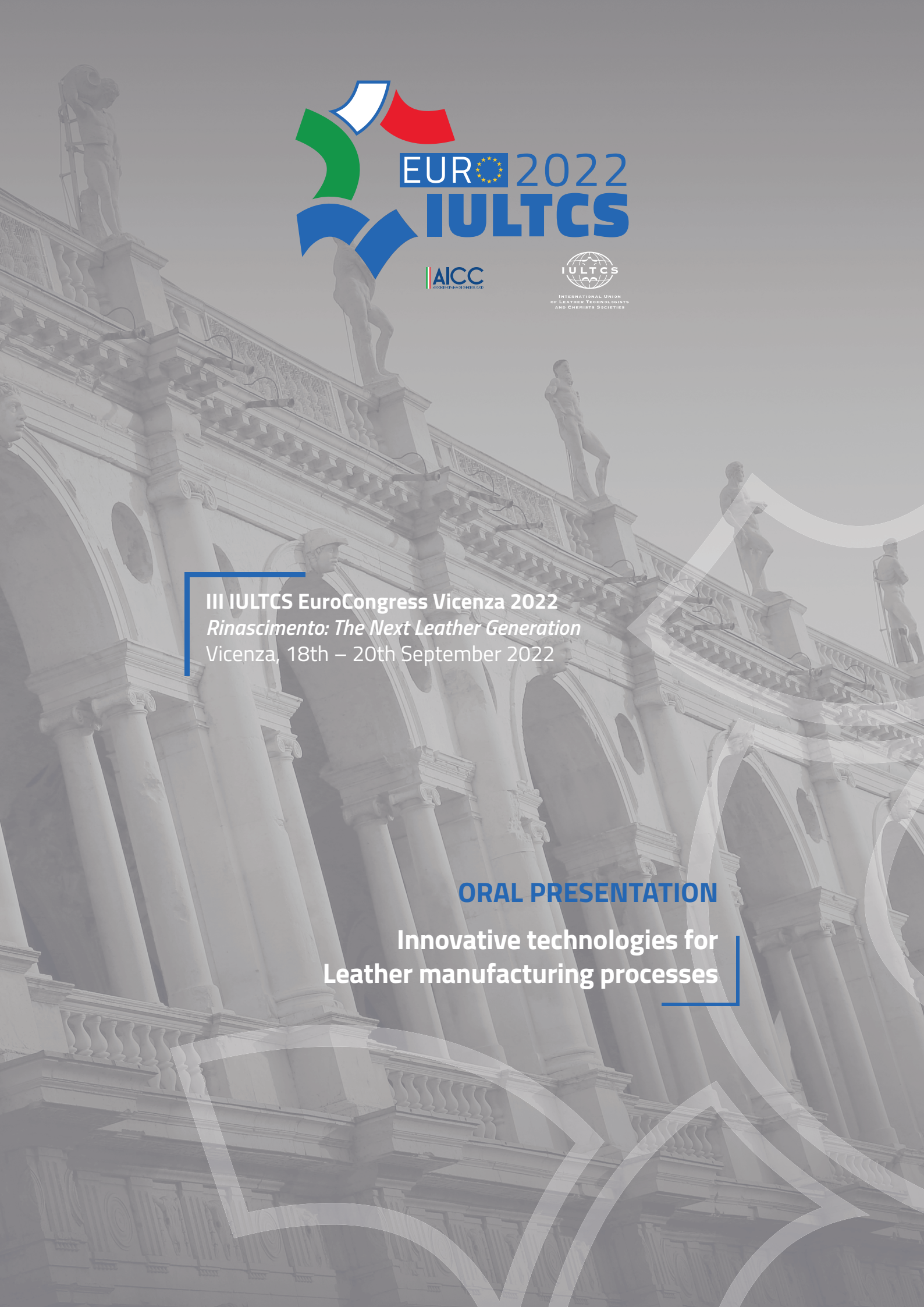
Technical innovation is achieved through following points:

- Process can be completed between 24/48 hours
- Operations of the process can be conducted easily by operators and in safety conditions thanks to non-dangerous products used
- Resolution of the problems of temperature and of excess of use of sulphide-based products

Flexible application is achieved through following points:

- With this process is possible to choose between hair-pulping and hair recovery
- It can be applied to many different types of raw hides
- Different tannings can be applied
- Different good quality articles can be realized

**Note**



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## ORAL PRESENTATION

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