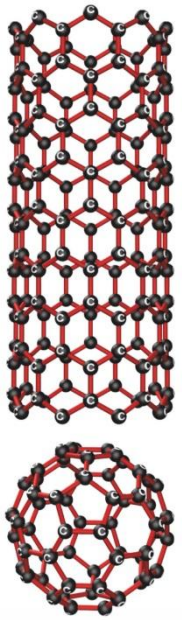

LANXESS
Energizing Chemistry

Green Beamhouse – A toolbox for cleaner Waste water

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Alcanena, 28.11.2019

Sustainability has become one of the mega-trends – also for leather production

Sustainability is target

- UN-sustainability goals have an affect on production and waste water management in tanneries (target 6 / 12)
- Key target is the reduction of waste water by reduction, reusing or recycling of negatively impacting substances
- Beamhouse is the production step with the largest impact on waste-water
- Lanxess has developed Green Beamhouse – a toolbox system for the improvement of waste water

Green Beamhouse – a toolbox for improving waste water by chemical recipes

Target of lower waste in waste water can be achieved in different ways

Process-based improvements

Waste water improvements which require change of tannery processes or different mechanical processes, e.g.

- Fresh hide utilization
- Green fleshing
- Lime recycling
- Hair saving process

Product-based improvements

Waste water improvements which require changes of the recipe. It can have significant impacts on all relevant waste-water components, e.g.

- COD
- Sulfide
- Nitrogen
- Salt

Green Beamhouse Toolbox

COD Improvement: Removal of hide components and reduction of surfactants by enzymatic process

General idea / theory

Origin of COD

- Organic matter of raw hides which is washed out during beamhouse process
- Organic beamhouse chemicals added to the process and finally end up in waste-water as COD

How to avoid COD

- Avoidance of unnecessary hydrolysis of the hide / switching to hair saving process
- Reduction of organic chemical additives by switching to enzymatic process

LXS product solution

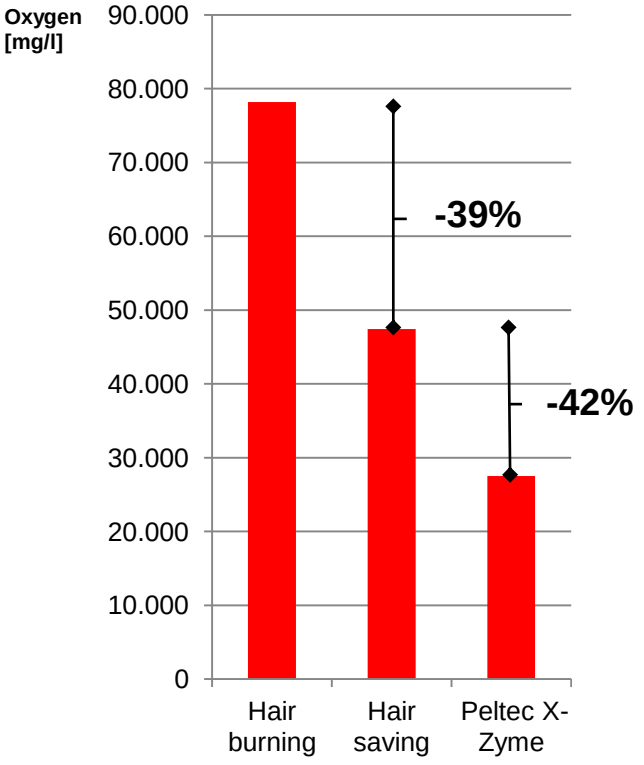
Peltec X-Zyme SN

- Enzyme-based product ensuring the mild washing out of hyaluronic acid during soaking
- P. X-Zyme SN reduces otherwise required surfactants that end up as COD in waste water

Peltec X-Zyme U

- Enzyme-based product which cleaves the hair roots forming easily filterable hair
- Subsequent hair saving process allows significant reduction of COD

Impact of Peltec X-Zyme SN/U



Sulfide Improvement: Replacing sulfide containing reduction agents by enzymatic unhairing system

General idea / theory

Origin of sulfide

- Sulfides are added for unhairing in the form of Na_2S, NaHS or mercaptans

How to avoid sulfide

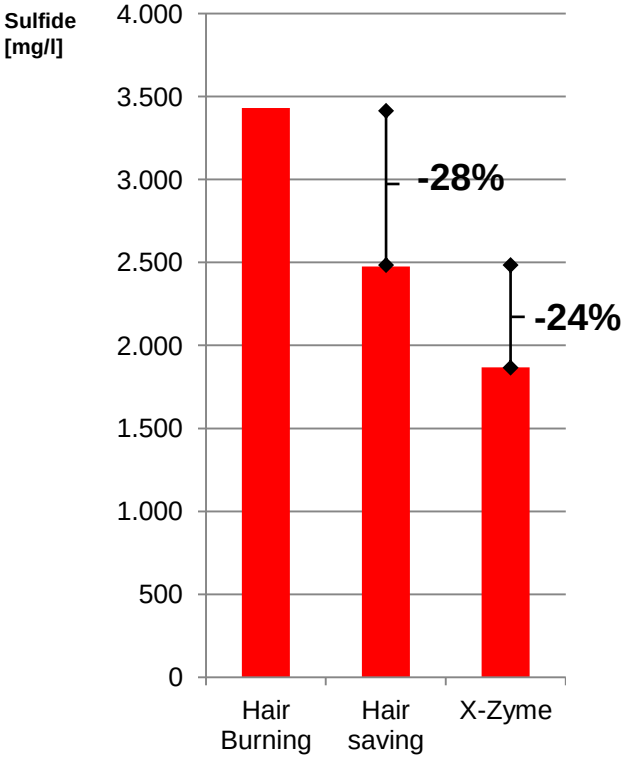
- Reduce required sulfide-volume by switching from hair burning to hair saving process
- Switching to a non-sulfide unhairing system (e.g. oxidative unhairing)
- Reduction of sulfide addition by utilizing enzymatic unhairing additives

LXS product solution

Peltec X-Zyme U

- Enzyme-based product cleaving the hair roots. Hereby partly substituting sulfide action and leading to less required sulfide
- Improved removal of hair roots leading to cleaner grain
- Pelts are reported to be flatter and smoother

Impact of Peltec X-Zyme SN/U



Nitrogen Improvement: Introduction of lime recycling and utilization of amine-free swell regulators

General idea / theory

Origin of nitrogen

- Nitrogen derives from proteins of the raw hides ending up in the waste water
- Swelling regulators in liming are traditionally based on amines

How to avoid nitrogen

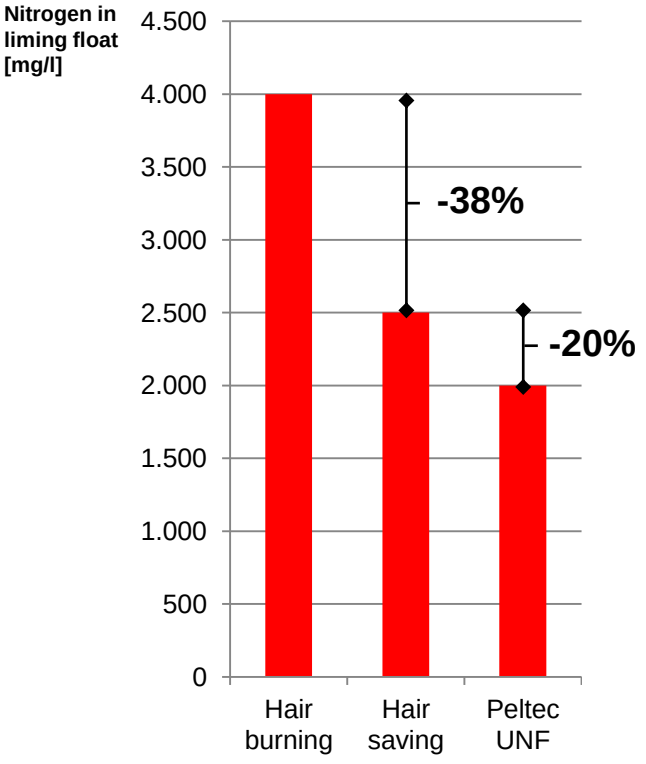
- Reduce amines from hides:
  - Liming: Switch to hair saving
  - Pickle: Shorten time and reduce temperature to avoid hydrolysis
- Introduce lime-recycling system which re-utilizes liming float including swell regulators
- Utilization of nitrogen-free swell regulators

LXS product solution

Peltec UNF

- Product is based on patent-applied nitrogen-free chemistry: No nitrogen is added to the float
- Product regulates the swelling during liming process and ensures good opening up
- No extensive plumping leads to reduced growth marks and belly draw as well as better removal of hair roods which results in clean pelts
- Cost competitive versus traditional products

Impact of Peltec X-Zyme S/U



Ammonia Improvement: Deliming with ammonia-free deliming agents

General idea / theory

Origin of ammonia

- Ammonia is added as a standard deliming agent to buffer the pelt after liming

How to avoid ammonia

- Utilization of ammonia-free deliming agents significantly reduce the nitrogen content in the waste water
- Current solutions (boric acid / dicarboxylic acids) have HSEQ-/ performance disadvantages

LXS product solution

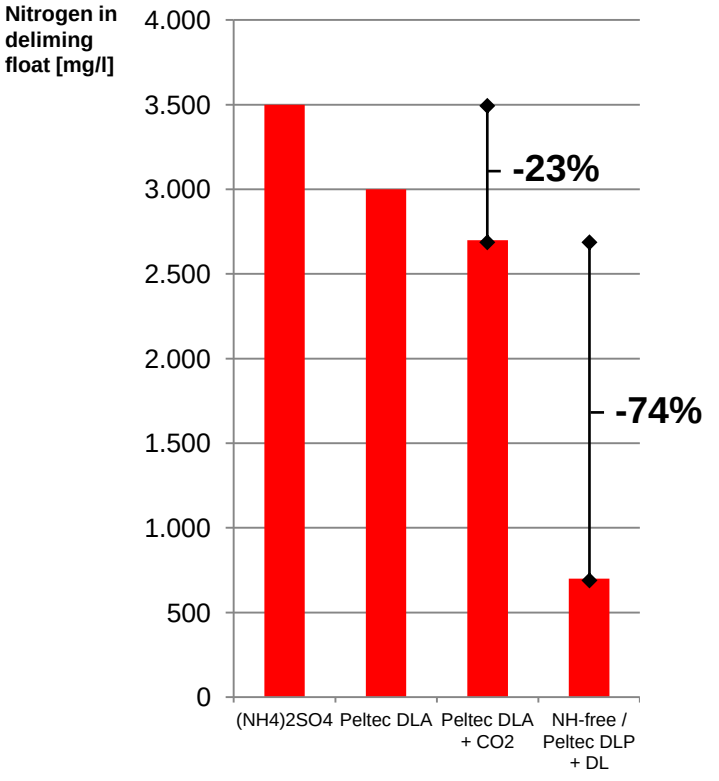
Peltec DLA

- Ammonia-reduced deliming agent which can be combined with CO_2 deliming

Peltec DLP / DL

- Products are completely free of nitrogen salts and ammonia compounds
- Peltec DLP quickly and uniformly penetrates even full substance pelts, time can be adjusted by addition of Peltec DL

Impact of Peltec X-Zyme S/U



Salt Improvement: Avoidance of pickle or utilization of a low-salt pickle

General idea / theory

Origin of salt

- Largest amount of salt derives from preservation (salting) of raw-hides
- Second largest salt-addition is during pickling, ending up in the waste water

How to avoid salt

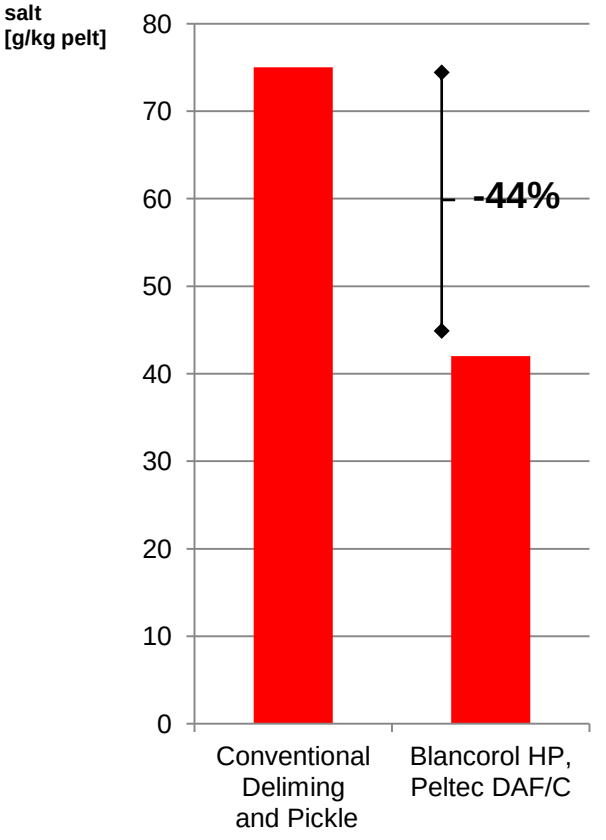
- Utilization of fresh hides
- Avoidance of pickle by switching to specific organic tanning agents (e.g. X-Tan®)
- Reduce pickle-salt addition by utilization of Blancorol HP

LXS product solution

Blancorol HP

- Blancorol HP helps to reduce salt requirements to 3,8 Bé (std: 6-8 Bé) => less salt in waste water
- 1.5 to 2% Blancorol HP (fully) replaces sulfuric acid plus partly formic acid
- Blancorol HP enables earlier chrome addition and reduces pickling time <1 hour

Impact of Peltec X-Zyme S/U



Green Beamhouse:

Lanxess' roadmap to cleaner waste water

Summary: Reduction factors of critical waste water components

Waste water component	Product	Reduction factor
▪ COD	Peltec X-Zyme SN+U	-42%
▪ Sulfide	Peltec X-Zyme U	-24%
▪ Nitrogen	Peltec UNF,	-20%
▪ Ammonia	Peltec DLP / DL	-74%
▪ Salt	Blancorol HP	-44%

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How to improve waste water

- Process changes (e.g. hair saving) have large effects on waste water
- Green Beamhouse offers further improvements by recipe changes
- Peltec X-Zyme process is the flagship for waste water improvements

Quality avoids waste