

ENZYME TECHNOLOGY FOR CLEANER LEATHER PROCESSING

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ECO FRIENDLY LEATHERS- APLF-2011- VISIONARY APPROACH

This year in APLF fair, many of the tanners displayed eco-friendly leathers, especially Ms Caprittarius associated with Ms AQSA International, displayed their stunning collection in sheep and goat, mostly metal free eco-friendly leather, visioned wide applause from all the Far East and European buyers. Enzyme washed Thumbled leathers, with the elegant natural look in sheep and goat or certainly a successful factor in countering with the chemically based process upon bio concept process. While considering all the EU norms and REACH norms, it is better for the tanners to rethink twice slowly eliminating the hazardous chemical process and replacing with the bio processing systems.

While most of the consumers prefer to use the bio products based on the chemical free nature, the tanners awaken and modified the conventional process to enzymatic process which helps the tanner's community contributing eco-friendly environment with the pollution free effluents.

Environmental friendly are used to refer to goods and services, laws, guidelines and policies considered to inflict minimal or no harm on the environment. The best step towards the eco or nature conservation is the use of eco friendly products in our day to day life. The present method relates to an eco-friendly beam house process for de-hairing of leather using commercially available enzymes that obviates the use of lime and other alkalis. The Leather industry world over is now facing problem for discharging effluents which are responsible for causing environmental pollution.



So the current study in the area of leather processing is focussing on the design and utilization of enzymatic process which results in cleaner and softer technology. The present invention also provides an alternate process for opening the fibres of leather using commercially available enzymes.

OBJECTIVE OF THE ENZYMATIC METHOD:

- To provide bio based beam house process that leads to significant reduction in the chemical oxygen demand and total solids load.
- To initiate the opening of the fibre structure
- To provide alternate tanning process that eliminates the requirement of pickling and basification of hide or skin.
- To enhance softness and elasticity
- To increase the area yield of the leather.
- To remove the wrinkle and folding in the pelt.
- To provide Eco friendly environment
- To provide an easier and convenient method that does not involve continuous lowering or increasing PH.
- To reduce the use of surfactants

- For Providing maximum recovery of the products
- To reduce the time consumption
- To minimize the lime sludge problem

CONVENTIONAL PROCESS VS ENZYMATIC PROCESS:

Conventional leather processing results in causing environmental pollution by discharging significant amount of environmental contaminants. But for the same process, the enzymatic method reduces the discharge of effluents by 90%. The emission of gaseous and aqueous discharge is large in the conventional process which is mainly responsible for global warming and climatic change. This is due to the high contribution of conventional process towards biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), chlorides, sulphides, sulphates, lime, chromium, etc. This is not in the case of the current invention since the enzymes not only efficient but also biodegradable. Also the conventional process is very tedious and time consuming since it involves many steps comprising soaking, liming, reliming, deliming, bating, pickling, chrome, tanning, basification, rechroming, neutralization, washing, retanning, dyeing, fixing. In enzymatic process, these steps are replaced through the biocatalytic process in which the uptake of various chemicals is achieved by process innovations. The management of effluents and usage of valuable resource like water in good quantity are the two main challenges faced by the conventional leather processing.

ENZYMATIC PROCESS:

Enzymes are natural protein which is highly specific and efficient catalyst. The main reason for using enzymes is that they are specific, non-toxic, non – pollutants and biodegradable in nature. This method is time consuming in which not only the processing steps reduced but also the usage of various chemicals. The various steps in the process are:

1. Soaking
2. Un – hairing
3. Fibre opening mechanism
4. Bating
5. Degreasing
6. Waste processing

1. SOAKING:

Soaking is the first important operation in leather processing. It is done by using amylolytic, lipolytic and proteolytic enzymes. Specific protease and lipase enzymes enhance water uptake by breaking down soluble proteins inside the matrix, thus facilitating removal of salts, hyaluronic acid, disperse fats and oils together with dirt and other contaminants present in the skin. It reduces the wrinkles in leather and thus loosens the scud. It also enhances the opening of fibre structure. The soaking process helps in bringing the best quality of leather since it cleans hides and skins by removing dirt, flesh, blood etc and re-hydrates skin back to state of green hides. Soaking can be done by using chemicals, surfactants or enzymes but enzymes are more suitably used because chemicals and surfactants cause pollution by increasing BOD, COD, and TDS content.

2. UN – HAIRING

Un- hairing is the process of removing hairs and furs from the skin or hides without causing any grain damage. Conventional process of un-hairing involves the use of lime and sodium sulphides which are responsible for causing pollution load. Enzymatic un-hairing is suggested as an environmentally friendly alternative to the conventional chemical process. With this enzymatic process, it is possible to reduce the chemical exposure and enhance the softness and area yield. The enzyme which is used for un-hairing is protease. The use of chemicals will completely dissolve the hair but the enzyme helps in filtering out the hair thus reducing the BOD and COD demand of the waste water. This current process helps in improving the strength properties of the leather with greater surface area and provide eco friendly environment to the workers.

3. FIBRE OPENING MECHANISM:

Fibre opening enzymes are provided for the mechanism which seems to reduce the pollution load and need for water treatment thus proving cost effective. The collagen is bound by proteoglycans which contain protein and glucose linked by the glycosidic linkages. This enzyme based fibre opening mechanism follows the bio – processing method which is totally different from conventional

chemical based process. Carbohydrases are the enzyme used in fibre opening that degrades specifically the proteoglycans that opens the fibre for entry of water which causes swelling. Removal of proteoglycans results in softness. In conventional process, lime is employed for fibre opening which spoils the environment by causing pollution. Hence this method helps in reducing the lime sludge problems.

4. BATING:

Bating is an important process in which enzymes plays a very crucial role whose purpose is loosening and peptization of the non collagenous skin structure through the removal of the residues of the interfibrillary proteins. Proteolytic enzyme is mainly used in the bating process. It helps in removal of lime and other non collagenous proteins that causes cementing which results in lack of flexibility.

5. DEGREASING:

Lipases are a type of enzyme that specifically degrades fat and so cannot damage the leather itself. Lipases hydrolyse not just the fat on the outside of the hides and skins, but also the fat inside the skin structure. Once most of the natural fat has been removed, subsequent chemical treatments such as tanning, re-tanning and dyeing have a better effect.

The main advantages of using lipases are a more uniform colour and a cleaner appearance in the pelt. Lipases also improve the production of hydrophobic (waterproof) leather; makers of leather for car upholstery have commented that 'fogging' is reduced. This is the term for the build-up of a film of chemicals on the inside of car windscreens.

6. WASTE PROCESSING:

Effluent discharges from leather processing industries create health hazards and environmental problems unless these wastes are properly treated. Fleshings, the major solid waste generated at the pre tanning operations were hydrolysed using pancreatic enzymes. Trimmings obtained after liming had the alkalinity that corresponds to pH 10. So this is being treated with alkaline protease. This process is usually conducted at constant temperature 55°C favourable for the enzyme. A combination of

hydrolytic enzymes, viz. proteases, carbohydrases and lipases can be used.

CONCLUSION:

The enzyme based leather processing method seems to be Eco friendly when compare to the conventional chemical process. This method helps in improving the sustainability of the enzyme in the global industries. It brings a significant reduction in the use and wastage of water. This bio-catalytic integrated process is technically feasible and viable without compromise in the quality of processed leather. We suggest the tanners to adopt this kind of bio processing systems and slowly upgrading the traditional methods to remain in the tanning field with the eco-friendly nature.