Current leather processing involves four important sets of processes, viz., pre-tanning, tanning, post-tanning and finishing. It includes a combination of single and multi-step processes that employs as well as expels various organic and inorganic materials. One of the process inefficiency is that the conventional leather processing employs several acidifications (pickling and fixing) and deacidification (basification and neutralization) steps. This results in a net increase in total dissolved salts (TDS) of about 30% in tannery wastewaters.

**A Prospect of Transposed Leather Process**

From pre-tanning to finishing, conventional leather process requires about 15 steps, which produces enormous amounts of wastewater and pollutants including sulfides, chlorides, sulfates and other compounds. The new process flips convention around - prior to tanning, for instance, delimed skin is treated with chemicals normally used after tanning is completed. In other words, transposed leather making process treats the delimed pelts with post tanning chemicals such as syntans, dye and fatliquors followed by pickle less chrome tanning at pH 5.0-5.2. The offer of post
tanning chemicals has been designed and calculated taking into account the shaved weight parameters.

**Basic Principle Behind the Transposed Leather Process**

It is well known that most of the post-tanning auxiliaries such as syntans, dyes and fatliquors are anionic. The post-tanning process involves neutralization of the cationic charge of the chrome tanned leather by elevating the pH of the leather to 4.5 – 6.5. This is followed by the application of post-tanning auxiliaries after washing off the neutral salts and addition of acid to fix these auxiliaries with the leather matrix. The logic of transposed leather process involves the use of the pH condition of the delimed/bated pelt, which is 7.0-8.0, for the application of post-tanning auxiliaries, because the pelt is anionic in nature. After the penetration of post-tanning auxiliaries, a slight decrease in a pH to a level of 5.0-5.2 would not only facilitate the fixation of the post-tanning auxiliaries but also provides proper conditions for the application of basic chromium sulfate salt for pickle less tanning. In other words, a simultaneous penetration cum fixation of chromium molecules would take place. The final pH of leather as well as the spent liquor would be around 4.0 due to the hydrolysis of chromium molecules. Hence, there is no need for a separate basification step. Transposed leather process - beginning where conventional process normally ends – would save time, energy, and chemicals while drastically slashing water use and pollution.
Water Consumption and Discharge

The transposed process enables significant reduction in the consumption of water because it avoids several acidification, deacidification and washing steps. Transposed process enjoys a reduction in water consumption and effluent discharge by 65 and 64% for processing 1 ton raw skins from pickling to post tanning. In this context, the ability of the transposed process to reduce the water consumption is one of the significant achievements.

Environmental Benefits

It is expected that the TS load will be significantly lower for the transposed process compared to the conventional process. This is primarily due to the fact that the transposed process eliminates several acidification-deacidification steps that are practiced in the current leather processing sequence. It is known that acidification-deacidification steps would lead to the formation of neutral salts that contribute to dissolved or total solids. The reduction in COD and TS loads are 53 and 79%, respectively for the transposed process. These reductions are not only due to the elimination of several processes but also due to the better uptake of chemicals such as chromium, syntans, dyes and...
fatliquors. Also, transposed leather process significantly reduces the time, power, water and chemicals by avoiding several acidification and deacidification steps. Hence, there will be a considerable net saving if one can adopt this process. It is intriguing to note that these benefits are without altering the process chemicals or using any specialty chemicals.

**Quality of the Leathers**

Physical strength and bulk characteristics of leathers obtained from transposed process are comparable to that of conventionally processed leathers. All the gains are possible without compromising on the quality of the leathers.

The sustainability of Indian leather industry would depend on the development of an alternative system for leather making. In this scenario, the developed transposed leather process forms a technically as well as economically viable alternative for making leathers. The "easy-to-adopt" transposed process is "greener" and less costly than traditional leather process and could even help the global industry overcome emerging environmental and economic concerns.

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