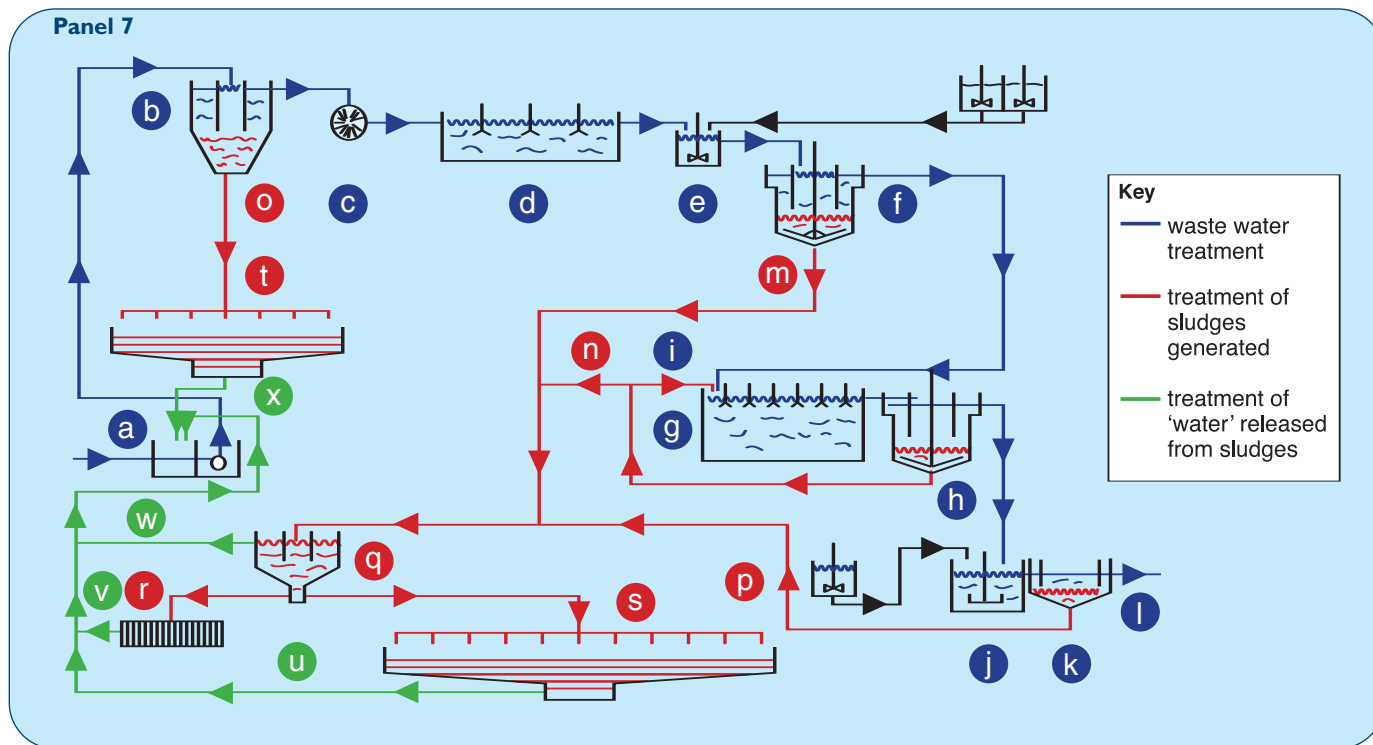




Primary effluent treatment



It is recognised that the first stage in the treatment of wastes from any process operation is to use the most appropriate materials and optimise performance. However, even after applying the best available technology to leather making, waste remains.

Today, because of the large volumes of water consumed and the high pollution potential, waste-water treatment is the prime item for waste management. Consequently, prevention and treatment is recognised as an integrated part of leather making. Moreover, good treatment is expensive; the capital cost of a conventional treatment plant has been estimated at approximately 30% of the cost of a new tannery.

Due to the complexity of the products released from raw hides and skins in processing, and the variety of residual products formed in their conversion into leather, waste-water processing involves physical, chemical and biological treatment. A flow diagram for treating effluents combined from many tanneries (Common Effluent Treatment Plants or CETPs) is presented as Panel 7. This is followed by an overview of the treatment, and discussions covering common variations. This approach is broadly followed by tanneries operating their own effluent treatment; however, there are differences for good reasons and these are addressed. The photographs used are from many CETPs and individual tanneries.

a RECEPTION

Effluents are received in a reception sump, and from this point they are delivered by pump to the first stage of effluent treatment. The reception can include either fixed or mechanical screens to remove large solids.

b c REMOVAL OF GROSS SOLIDS

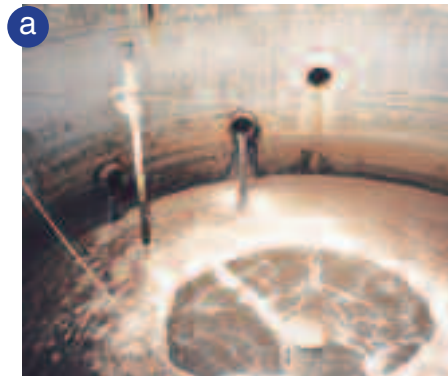
Hair debris, grits and other solid material that settle rapidly can be removed by primary settling. The effluent flows into a cylinder fitted in the centre of the vessel so the flow is directed towards the base. The upward flow is designed to be slower than the rate of precipitation, so that solids

are retained.

The settled effluent then flows from the top of the vessel using notched weir plates. If fine solids, such as hair residues tend to carry over from this stage, a fine screening using self-cleaning screens can be introduced (c).

d EQUALISATION AND AERATION

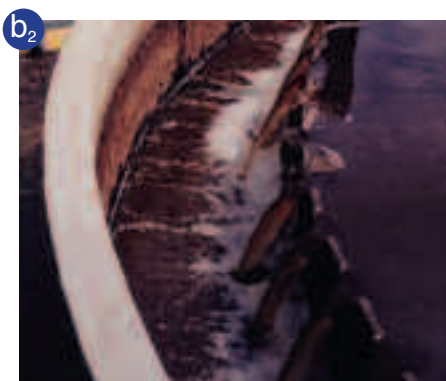
The waste-waters discharged from different parts of the leather making process vary both in volume and characteristics. The flow rate and pH therefore needs balancing and the effluent composition equalised. A holding tank is thus employed where the mixed effluents



Reception sump for various tannery waste-waters. After screening for gross solids, the effluent is pumped to the primary settling stage.



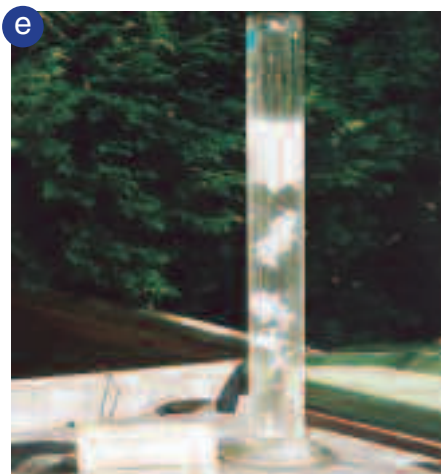
These massive primary settling vessels are carefully designed so that the settled solids can flow as a sludge from the conical base without danger of blockage.



Weiring of effluent after primary settling.



Balancing and equalisation, with catalysed oxidation of sulfides. In the absence of primary settling, careful attention must be given to pre-screening. Solids can build up in this stage, and it is prudent to take this into account in design to enable periodic cleaning.



Dosing with coagulants and polyelectrolytes causes fine solids and colloids to clump together to form large flocs with a relatively fast settling rate.

are generally retained for 24 hours. During this stage inter-reactions occur between some of the components to form fine suspended solids or colloids, and the characteristics of the effluent become more uniform.

Aerators are employed to ensure a thorough mixing and to prevent any settling of solids at the base of the holding tank. They also provide oxygen to the effluent, so that in the presence of catalysts toxic sulfides are oxidised into non-toxic sulfates. Finally, the induced oxygen prevents the system from becoming anaerobic.

e CHEMICAL DOSING

The equalised waste-water is then dosed in a 'flash' mixer with lime, coagulants and polyelectrolyte. The lime is used to maintain the optimum pH for the most effective use of aluminium or iron salts as a coagulant. Reactions occur with solubles and colloids in the effluent - such as proteins, polyphenols and resins - and the polyelectrolyte assists the settling of these precipitates. Jar tests are required daily to determine the required dosages.



The chemically dosed effluent is delivered to the centre area of the clarifier, and directed towards the tank base to assist settling. The 'bridge' spanning the tank is part of a slow-moving scraper mechanism.



Image shows weiring of the clarified effluent, and details of the roller arrangement supporting the scraper mechanism.

f PRIMARY CLARIFICATION

The chemically dosed effluent flows to a primary clarifier, the purpose being to separate the precipitates and fine solids from the effluent. The clarifier design differs from the pre-settling tank (b), as the solids need a longer settling time. As the design depths are similar, so the surface area increases, and this in turn makes the evacuation of sludge more difficult. A slow



In smaller effluent treatment plants, 'Dortmund tanks,' or similar structures, are used. Scraper mechanisms are not required, but the base angle must be greater than 65° to avoid either blockages, or sludges that become diluted with effluent on discharge.

moving scraper is therefore used at the base of the tank to channel the sludge to the centre. The sludge is then pumped to a dewatering press or a solar sludge drying bed. As a result of this primary treatment, according to composition, between 50-75% BOD, 50-75% COD and more than 95% of the SS can be removed.

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Part 5: April 2004; Part 7: June/July 2004