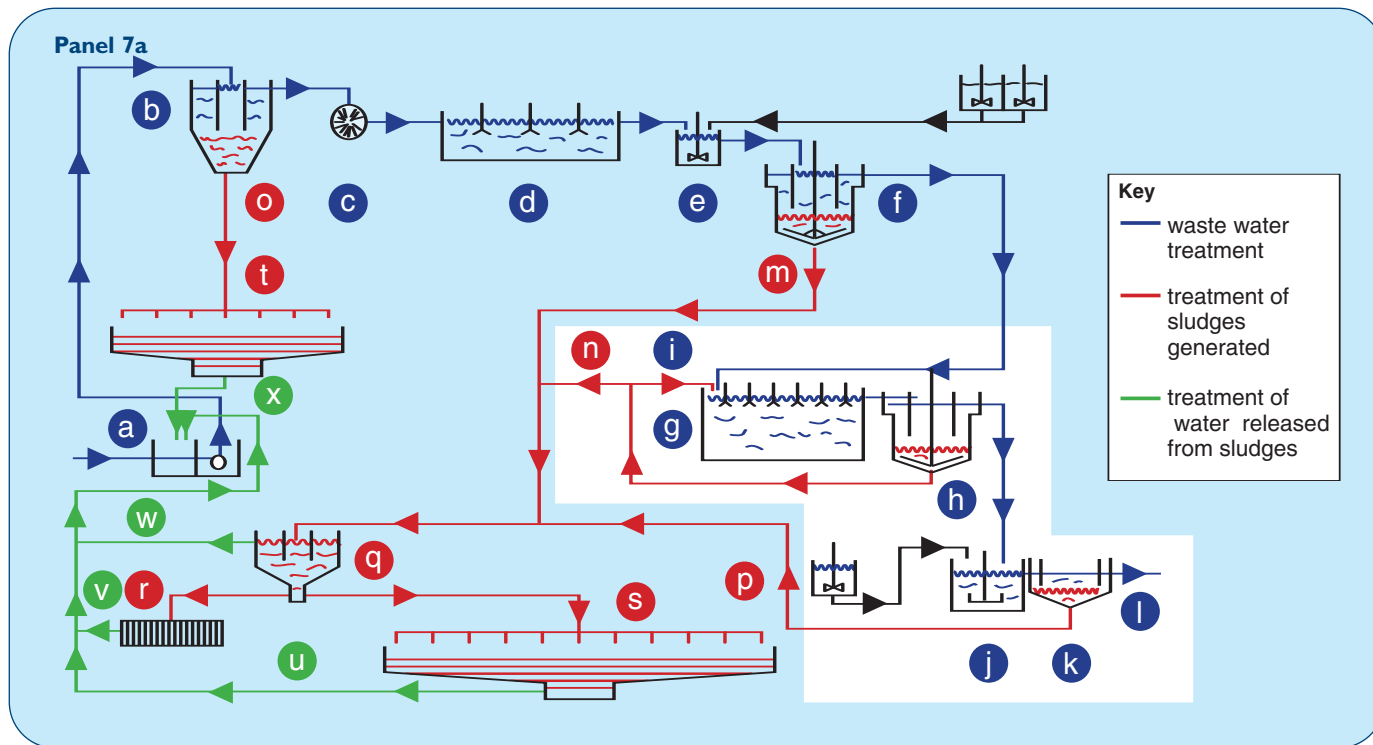




Secondary effluent treatment



g h i BIOLOGICAL TREATMENT

After separation of the solids from the effluent by primary clarification (f), the supernatant is delivered for aerobic biological treatment. Known as the activated sludge process, the effluent requires continuous aeration to ensure a constant supply of oxygen for the bacteria, and to keep the bacterial flocs that develop in suspension.

There are many different ways to provide oxygen to the process, but the most common is by air induction using surface aerators, diffused aerators, and venturi systems. The viability of this process depends upon the right volume of oxygen being provided. Under these conditions the biodegradable components in solution are converted into bacterial mass, which can ultimately be settled from suspension. The parameters often vary, so for optimum performance constant monitoring is required. The main points of control are:

- The dissolved oxygen present in the process. Without oxygen the bacteria rapidly die, but too much results in very thin sludge formation.
- The measure of solids held in suspension (mixed liquor suspended solids or MLSS).

SECONDARY CLARIFICATION

Secondary clarification is an integral part of the activated sludge process. With a design arrangement similar to the primary clarifier, (f) the waste-water and bacterial mass are continuously drawn from treatment and feed into a secondary clarifier (h). The biological solids are very slow to settle, but form a thin sludge of about 1-2% solids.

Some of this sludge is removed for dewatering (n), however, part is returned to the aeration stage (i) for further biological treatment.

This return is central to the whole process as this enables further breakdown of the biomass into water and carbon dioxide. The operation is managed by careful attention to the MLSS, being controlled by the level of sludge returned for biological treatment.

This technique enables a bio-sludge reduction of about 50% before final disposal. The supernatant weiring from secondary clarification is the treated effluent with considerably reduced BOD₅ and COD concentrations. If it conforms to prescribed standards, it can be discharged.

j k l TERTIARY TREATMENT

Often, waste-water from secondary treatment receives tertiary treatment.



g₁ Activated sludge treatment at a CETP. In this example, aeration is provided by diffused aeration.



g₂ Surface aerators are most commonly used for mixing and aeration.



Separation of the very fine bio-flocs as part of secondary clarification.

Depending on the quality of the treated effluent, a second chemical dosing and settling may be applied to reach the required standards and colour removal before discharge (1). Aluminium salts and polyelectrolyte are commonly used, forming very fine flocs. These can be settled out using specially designed settling tanks, but often large shallow lagoons are employed. Effective biological treatment can also be provided by reed beds. Other techniques include sand filtration and activated carbon.

Richard Daniels

Part 6: May 2004

Part 8: August/September 2004



Tertiary settling after chemical dosing. The clear supernatant flowing over the notched weir is ready for discharge as treated effluent.

Panel 8

Common and individual effluent treatment systems

Common Effluent Treatment Plants

It is important that tanneries discharging to CETPs provide certain forms of pre-treatment. In particular there must be screening of gross solids as there are real dangers of blockages in long delivery systems.

It is often possible to segregate effluents within individual tanneries for separate treatment, such as the treatment of used chrome liquors. Nevertheless, because of the number of providers, the full advantages of any in-house treatment can never be fully gained.

There are also many examples where CETPs receive domestic effluents for treatment. This may provide benefits in terms of dilution, especially with regards to the sodium chloride content, and within biological treatment, and may offset capital and running costs. The CETP removes much of the environmental responsibility and management from the tanner, and may provide cost advantages due to funding arrangements.

Effluent treatment by individual tanneries

Individual effluent treatment plants require a different approach. In this situation the tanner will find that effluent management is more effective if attention is given to the treatment of separated waste streams, and a 'clean' approach to leather making processes. Also, technology is often available that is better suited to the scale of individual tanneries rather than the scale demanded by CETPs.

SEGREGATION AND TREATMENT OF SULFIDE WASTE-WATERS

The most common practice with individual effluent treatment plants is the segregation of sulfide-containing waste streams. This allows the oxidation and removal of sulfide before mixing with the bulk of the effluent. This means that the aeration section can be smaller and better controlled, and the risk of odour caused by evolved hydrogen as the pH reduces on balancing is avoided.

TREATMENT OF SEGREGATED USED CHROME LIQUORS

The full collection and segregation of used chrome liquors is common. Chrome waste-waters are often retained as a relatively low volume component, so the chrome is easier to precipitate and recover as sludge for dewatering. This is a better option than treating a fully mixed effluent as the sludge produced will be high in chrome and disposal more difficult. A segregated chrome sludge will, however, be of small volume for disposal or regeneration, while solids from the rest of the treatment plant may have possibilities for land application.

CENTRIFUGE APPLICATIONS

The centrifuge can be found as a replacement for primary settling. Although high in power requirements, this approach is especially valuable where space is restricted. In addition to separation, the centrifuge delivers compact solids for disposal as opposed to a sludge that requires dewatering. Applications are also possible in the role of secondary clarification.

SEPARATION BY FLOTATION

In conjunction with chemical dosing, air can be introduced into the system so that, instead of separation by settling, the solids rise to the surface to form a floating mat. These solids tend to be of a higher solids content than achieved by settling, and can be mechanically skimmed from the surface. The units are compact, and provide a useful alternative to primary clarification.

MEMBRANE APPLICATIONS

Membrane technology enables the separation of mixtures, even solutions, into their component parts as a low volume/high strength concentrate, and high volume/low concentration permeate. Used chrome and vegetable liquors can be concentrated for in-house recycling, and within biological treatment, the bio-mass (MLSS) can be built up to approximately ten times normal concentration as part of rationalisation. (See Part 10, Panel 9)

REDUCING POLLUTION AND VOLUME

There are two prime examples. If hair can be retained as a compact compostable solid this can provide important advantages. There is a major reduction in the COD/BOD and suspended solids for treatment, and a lower volume sludge for disposal. This is a considerable incentive for the individual tanner. Water saving also provides very direct benefits. If the volume is reduced, then in addition to lower water consumption, the size of the effluent treatment plant is smaller, with lower associated costs.

Basically, within individual systems, the treatment and size can be more closely built around the manufacturing process. It is important to recognise that the techniques employed can be highly individual, both in response to a particular production technology, and taking into account site limitations and the demands of a particular location. Benefits may be more readily apparent from evolving technologies within manufacture; however, the costs incurred can be considerable.