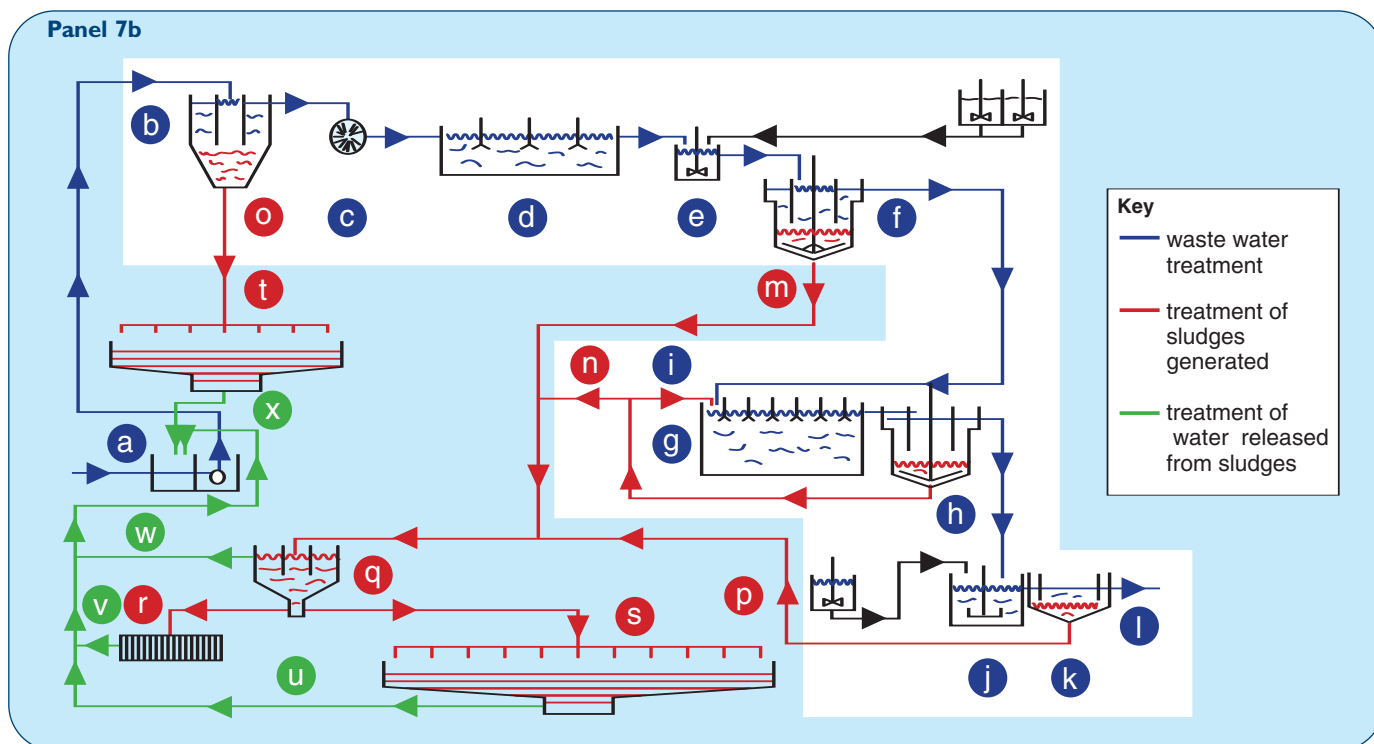




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Other options for treatment



There are many variations that can be applied to effluent treatment. For example, the primary settling stage (b) is often omitted, but in this event there is more attention to pre-screening (c). If iron salts are used for coagulation (e), then sulfides are simultaneously precipitated, thus avoiding catalysed aeration within the balancing stage (d). In some situations, the chemical dosing stage (e) is omitted so that effluents from balancing and aeration only (d) are clarified (f), then delivered for biological treatment.



Effluents can be biologically treated by passing them through the root structure of reeds as a cost effective alternative for secondary and tertiary treatment.

There are also variations within biological treatment, including reedbed technology as an effective option that can replace chemical dosing, secondary and tertiary treatment.

However, a major variation that can be found in warm climates is the use of anoxic technology.

Treatment by lagooning

If an effluent is simply discharged into a series of lagoons or settling pits, balancing and equalisation occurs, and a high removal of suspended solids. However, in due course the combination of warmth, oxygen from the air, sunlight, bacteria, microorganisms and algae will cause the effluent to break down in part. These systems are mainly anaerobic; however, the surface layers are aerobic, with the zone between these two layers being deficient in oxygen or anoxic. These systems are very basic, and the retention times are very long; however, variations are employed that include surface aeration. The systems suffer from a gradual solids build up, so eventually they need closing down, the sludge allowed to dry, then cleaned out. The process is simple, but the performance



Holding periods of around 10-30 days are used in simple lagooning to reduce the BOD/COD and suspended solids.

is poor compared with the activated sludge process.

Nevertheless, examples can be found where this technology has been rationalised as part of reducing the BOD/COD of tannery effluent.

EXTENDED EQUALISATION

Individual tanners sometimes employ an anoxic equalisation stage. This can occur naturally in hot climates, when primary holding times are extended to two to three days without aeration.

There are also examples of this within several CETPs, but after chemical dosing (e) and primary clarification (f). In ➤



Extended equalisation requires a very large area, as the holding times are long.



After anoxic treatment the effluents need degassification to oxidise and flush sulfides from solution of effluent, before offer to the activated sludge treatment stage.

this situation, the supernatant is retained for 8-10 days in a holding tank. Although the surface layer becomes anoxic, as there is an absence of oxygen in the bulk of the system, being about 3m in depth, the system can be regarded as mainly anaerobic. It is said that this digestion can remove a further 15-20% of the BOD.

However, the process also reduces sulfates to sulfides, and amines to ammonia, and thus can be the source of considerable odour. After this treatment the supernatant needs degassification. High-speed surface aerators are used to flush the hydrogen sulfide from solution. The effluent is then offered to conventional secondary treatment. Nonetheless, it is said that some products produced by this treatment can cause inhibitions.

Extended treatment is low cost in terms of energy use, but requires a considerable land area as the retention times are long. In addition the holding tank or lagoons can smell foul, and odour can be a problem if sludges are spread over a large area for natural drying.

In some situations, because of the large holding area, the design assumes the total breakdown of sludge over a long time period. As this does not occur, the solids build up creating a long-term problem.

Anaerobic digestion

Another form of rationalisation can be found in the Upward Anaerobic Sludge Blanket approach where, after balancing and equalisation, the effluent is pumped into the base of a reaction vessel. The effluent flows upward, passing through a blanket of anaerobic sludge where anaerobic digestion takes place. The process is very sensitive to sulfide and ammonia when used on tannery effluents alone, but under the right conditions the UASB can work if blended with domestic sewage in co-digestion. Nevertheless, the performance only



As part of nitrogen removal, the anaerobic section can be constructed within the aerobic part. Stirrers keep the effluent in motion within this central section.

achieves the levels expected of chemical dosing and is poor when compared with aerobic technology.

The removal of nitrogen

Nitrogen can be removed by a combination of aerobic and anoxic treatment. In parallel with the lowering of the oxygen demand within activated sludge treatment, species of nitro-bacteria first oxidise ammoniacal nitrogen to nitrite, then to the nitrate state.

In a second stage, under oxygen-deficient conditions, facultative bacteria utilise the oxygen associated with the nitrate, to form water and nitrogen gas. In practice, these conditions are needed alternatively, so often the facultative section is built adjacent to an existing activated sludge treatment plant. The effluent is pumped between them at a rate determined by the capacity of



The Pasveer Ditch: rotating brushes at several points in a circular raceway generate circulation and aeration. Aerobic conditions are maintained down-stream from the rotors, but at greater distances anoxic areas can develop and thus support nitrogen removal. These factors are managed by careful rotor control.

this additional stage.

In the Pasveer Ditch form of activated sludge treatment, the depth of the effluent is only about one metre, hence a large surface area. The effluent is circulated, but can be managed so that anoxic areas can become established within the plant. This enables denitrification within the mainly aerobic system. ●

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*Part 7: June/July 2004
Part 9: October 2004*