



The problem of marine discharge

Richard Daniels, Technical Editor

The marine environment is sensitive, but because of the problems of dealing with salinity, massive clusters of tanneries are now located near to the coast in order to discharge these effluents into the sea. The simple assumption is that, because sea water is saline, a bit more salt diluted in the sea won't matter. But it's not that simple.

More clusters of tanneries are planned with access to the sea, but in most areas the standards limiting discharge are far more lenient than their inland equivalents. In this situation the more difficult components contained within the effluent remain when it is discharged into the sea.

As high salinity values inhibit bacterial activity, it is likely that the biological breakdown of effluent components—especially man-made organic products—will be far slower than under the conditions found inland. This means a greater risk of products not found in nature persisting and entering the marine food chain.

There is often confusion between the salinity of an effluent and the Total Dissolved Solids (TDS). Salinity arises from common salt (sodium chloride) that is normally used for preserving hides and skins, from the acid-salt pickle, and as a component within some auxiliary products.

Salt is so stable that it cannot be removed through normal effluent treatment. It can only be removed after full effluent treatment through the concentration of the effluent followed by evaporation. In practice this may include the segregation of effluent streams, the use of membrane technology to produce clean water fit for re-use, and evaporation of the concentrate.

The discharge of a high salinity effluent is only acceptable if there is a considerable dilution so that any increase in salinity is acceptable within the wider environment. In the case of discharge to inland surface waters, authorities can consider the conditions that prevail before accepting the effluent, and downstream effects that might include accepting other effluents. In effect a mass balance is needed that takes into account the

needs of the downstream environment. If there are differences in dilution—for example less dilution due to dry periods—then this should become part of the equation.

The TDS of an effluent is a measure of all the materials in a settled effluent, and thus can contain many chemicals. Over and above common salt, there are products that can be viewed as acceptable under some circumstances. If the effluent is being used for crop irrigation, then calcium and magnesium ions and protein breakdown products can be useful.

The products found in the TDS of an effluent that has simply been mixed are both inorganic and organic. The inorganic components can include metal ions from tanning and some dyestuffs, as well as calcium, magnesium, manganese iron and sodium. With the exception of sodium it is possible to remove all of these residues by chemical treatment.

The organic products can be viewed as by-products from protein breakdown, residues from natural sources—such as vegetable tanning products—and synthetic compounds. All of these organic products contain carbon, and their potential for pollution is measured by their demand for oxygen, as is required for their breakdown. This can be measured in two ways:

BIOCHEMICAL OXYGEN DEMAND (BOD)

This is a measure of the oxygen demanded by bacteria to achieve breakdown of an effluent under carefully controlled conditions over a set time. The bacteria that are employed are common to effluent treatment plants, and the process simulates natural decay.

CHEMICAL OXYGEN DEMAND (COD)

This is a measure of the oxygen required for the breakdown of effluent components, but with the oxygen provided under extreme chemical conditions. In this situation the breakdown can be considered complete. ➤



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INTERMEDIA HOLLAND B.V.
 P.O. Box 952
 5000 AZ Tilburg, Holland
 +31 13 532 11 36
 +31 13 542 71 75
 info@intermedia-holland.nl

Postal address
 Phone
 Fax
 E-mail

This means that these two values are always different. The COD value is always greater than the BOD as the BOD value is limited by processes provided by nature.

In the best effluent treatment systems, many components that demand oxygen are removed by chemical interactions. These processes are moderate, the methods used by COD analysis being far too extreme to be considered. The remaining components are then subjected to biological treatment, and very good values can be achieved.

The inland discharge of effluents

It may be that these effluents are discharged to mix with domestic effluent, followed by municipal treatment. If the salinity is low, then the effluent may be used for land irrigation. In both of these situations the effluent components will be subject to extended retention times and more biological treatment before entering into the wide environment. If the discharge is released directly into surface waters, then very high standards are required and monitoring and control can be very stringent.

But where the wider environment cannot accept an otherwise acceptable effluent because of the high salinity, tanners are faced with severe problems often enforced by legislation. In this situation there are three options:

- Reduce the salinity by using salt-free hides and skins, and by altering the leather-making process
- Closure
- Relocation to coastal areas for marine discharge

Marine discharge: advantages to the tanner

Marine discharge can be a very attractive alternative for the tanner. Although it involves relocation, the forward-looking tanner can have a new start. New premises, a new factory layout that may better serve its purposes, possibly financial incentives, and the service benefits that tanning clusters can provide. In this situation, the burden of effluent treatment shifts from the individual tanner to a specialist organisation. Moreover, there is no limit to the level of salinity in the final effluent.

But there is another hidden benefit as, in general, the standards for effluent treatment are far more relaxed than those enforced inland. This means that there is less incentive for the tanner to substitute problematic chemicals or change processes to methods that are better for the environment. In addition, the capital costs of truly comprehensive effluent treatment are avoided, as are the high running costs that these incur, and the costs of disposal of solids generated by full treatment. In this situation, when the charges for treating the effluent pass to the tanner, then these will be less than the inland discharge situation.

The cost of marine discharge within the global environment

It is acknowledged that the marine environment is under stress due to pollution, and that even the most remote locations never remain in isolation. The classic example is pesticides that have entered the food chain, and have then been detected in penguins in the Antarctic.

Tannery effluent is moderately saline, so in normal biological treatment the breakdown is reasonably predictable. However, if effluents only receive cursory treatment, many compounds that are excluded from inland discharge—for good reason—are discharged into the sea. But the sea is much more saline, and high salinity strongly inhibits bacterial activity. In particular,

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anaerobic processes are severely affected by salinity, so the cycle of anaerobic/aerobic digestion—so necessary for the breakdown of persistent compounds—is severely inhibited or prevented.

In this situation the breakdown of all products, especially man-made organic compounds that persist, is inhibited. Not only do the products maintain the potential to spread, there is also a greater likelihood of them entering the global marine food chain.

Moreover, inland discharges and their effects are relatively easy to monitor: the effects of pollution become obvious and, if found to be unacceptable, can be controlled by legislation. But marine effects are far from obvious due to dispersion and there is no authority to safeguard the marine environment. There is, therefore, an absence of pressure on the polluter.

Tanning clusters by definition result in high local concentrations of manufacture. Very high volumes of effluent are discharged into the marine environment to standards that would be totally unacceptable inland. As matters stand at present, marine discharge following effluent treatment that can only be described as basic is taking place and more tanning clusters are planned for the future.

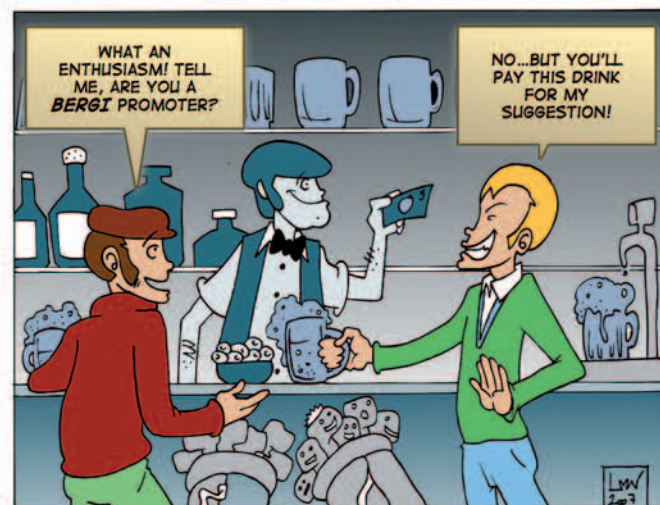
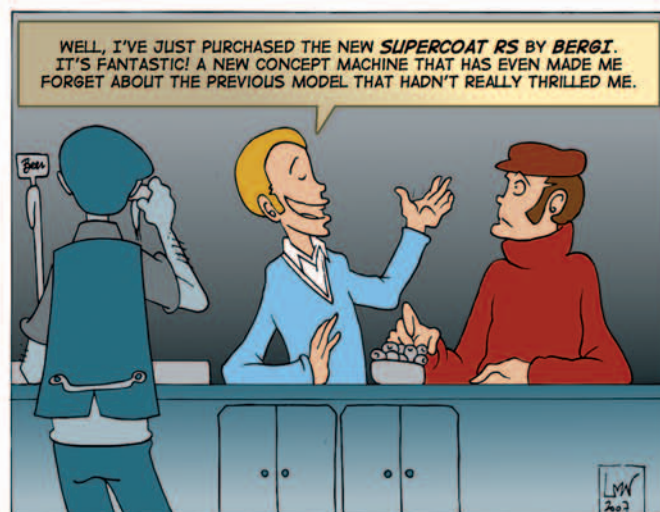
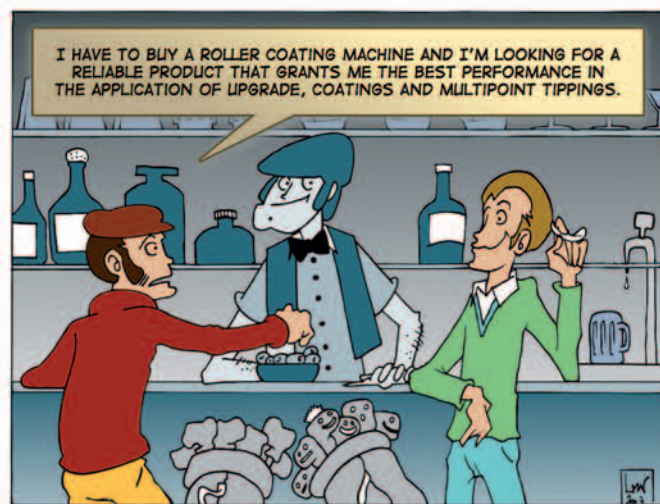
Marine discharge is an ideal way of avoiding the problems of salinity. And although it is acknowledged that some tanners have recognised their obligations to the wider environment and have applied full effluent treatment to effluents before discharge into the sea, vast volumes of effluent are being discharged into the sea at standards far below limits that have been recognised internationally as acceptable levels for discharge into the more aggressive inland environment.



Concerns raised by marine discharge

The damage caused by general pollution within the sensitive marine environment is well known. The effects of tannery effluents treated to standards perceived as basic when compared to inland discharges are unknown. This has raised a number of concerns, and can be summarised as:

- Are we sure that the benefits of vast dilution are greater than any long-term damage that might be caused by products that are never found in nature entering the marine environment?
- Given the relatively sterile conditions within the sea, and acknowledging the difficulties of monitoring the effects of pollutants as they are dispersed, should standards for discharge be at least equal to the standards that apply to inland discharge?
- The technology for quality effluent treatment is already well established. What justification is there—apart from local financial advantage—for the sensitive marine environment receiving less favourable treatment than the land? 🌐



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