Combined biologic removal of sulphate for tanning industrial wastewaters

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Background

Conventional treatment for tanneries wastewaters utilises chemical precipitation as pre-treatment followed by aerobic/anoxic processes for carbon and nitrogen removal, and has several drawbacks related with the cost of the chemicals, increase of waste excess sludge and incapacity to remove sulphates, adequately.

Tanning industry is widely present in Portugal and its wastewater effluents are hard to degrade in conventional wastewater treatment plants. Also, it generates high quantity of sludge, mainly chemical sludge, which after dewatering is disposed in industrial landfills. Such final disposal cost is significant, due to transportation and charge costs.

Application of anaerobic process is an attractive alternative, but often becomes less feasible to apply due to high sulphate concentration in the tanning wastewaters, that results in Sulphate Reducing Bacteria (SRB) out-competing Methanogenic Archaebacteria (MA). This imbalance is generating hydrogen sulphide at concentrations which are inhibitory for both populations of methanogenic and sulphate reducers.

Advances in Portugal

To overcome the technical hitches to apply anaerobic treatment for the sulphate rich industrial wastewaters, INETI (Lisbon, Portugal) has researched and developed a biological pre-treatment process based on anaerobic digestion (AD) reactor followed by aerated tank, for partial oxidation of sulphide into molecular Sulphur S° under oxygen limited conditions for sulphate rich wastewaters. Recycling of aerated sludge into anaerobic reactors allows sulphide concentration control. This solution was adapted to tanning industry effluents in 2006 when a small full-scale plant was built in Portugal, being the first full-scale application of this combined process.

Compared with conventional physico-chemical technology, AD followed by partial sulphide oxidation (PSO) AD/PSO process, has several advantages:

(i) avoid chemicals consumptions
(ii) removes (70 %) sulphates and (75%) COD
(iii) reduces energy consumption, about 60 % in subsequent aerobic/anoxic stages
(iv) achieves a solid compound, sulphur rich, reusable in alkaline agricultural land.

The new process developed in Portugal based on enlarged anaerobic consortium is very stable and made further progress on the applicability of AD to sulphate rich effluents, allowing fulfilment of sulphate concentrations lower than 1000 $mgSO_4^=$.

By controlling the REDOX value in the aerobic reactor it is possible to generate molecular sulphur S°, which bonds to sulphide ions when recycled in the anaerobic reactor; impairing toxicity and keeping stable biological sulphate and methanogenic conversions.

Further information for this technology can be requested by corresponding with:
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