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Wetland Technology

Practical Information on the Design and Application of Treatment Wetlands

Edited by Günter Langergraber, Gabriela Dotro, Jaime Nivala, Anacleto Rizzo and Otto R. Stein

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4.11.5 Winery wastewater

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Design objectives

The design objectives of winery wastewater treatment is usually based on the need to reduce the main pollutants, represented by the organic matter and solids, to limit the environmental pollution.

Wastewaters generated from wine production are characterized by: (1) large volumes (1.6–2.0 L of wastewater per litre of wine produced) and seasonal variability; (2) high concentrations of organic matter, with COD that varies from 340 to 49,103 mg/L and BOD_5 about 0.4–0.9 of the COD value; (3) variable amounts of TSS that range from 190 to 18,000 mg/L. The highest concentrations of organic matter and TSS are produced with the generation of the highest wastewater volumes (vintage and racking).

Processes required and TW type to be used

An equalization tank may be placed upstream of the treatment plant to reduce the qualitative and quantitative variability of wastewater.

The TSS and organic matter can be mainly removed by processes of filtration, sedimentation, mineralization and anaerobic degradation typical of subsurface-flow wetland systems.

Generally, in small wineries (<2,000 hL wine/year) the treatment plant consists of a septic or Imhoff tank, also with equalization function, followed by a single stage of HF or VF wetland. For medium-size and larger wineries different solutions are adopted (e.g., Masi *et al.*, 2015a): (1) multi-stage wetland (VF–HF–FWS; French VF–HF–FWS); (2) conventional technology combined with a TW (Upflow Anaerobic Sludge Blanket or Hydrolytic Upflow Sludge Blanket–VF–HF; Sequential Batch Reactor or Activated Sludge–French VF or VF).

Specific considerations during design and for construction

- *Malfunctioning prevention.* The feeding of HF wetland with high solids loading rates or with winery wastewater that has been poorly pre-treated leads to clogging phenomena and a reduction in performance in a short time. HF substrate clogging was observed with organic loading rates of about 500 g $COD/m^2/d$ (related to the surface area of the HF wetland).
- *O&M.* Low nutrient concentrations in raw winery wastewater can determine the need to use fertilizers to promote macrophyte growth in TWs. Fertilizer may be applied in the raw wastewater or on the wetland surface area after planting and at the beginning of each growing season.
- *Monitoring.* During the vintage period, it is advisable to monitor pH values in the raw winery wastewater to evaluate a possible correction of low pH by lime addition or similar alkaline chemicals.

Water quality standards across the world are being re-written to promote healthier ecosystems, ensure safe potable water sources, increased biodiversity, and enhanced ecological functions. Treatment wetlands are used for treating a variety of pollutant waters, including municipal wastewater, agricultural and urban runoff, industrial effluents, and combined sewer overflows, among others. Treatment wetlands are particularly well-suited for sustainable water management because they can cope with variable influent loads, can be constructed of local materials, have low operations and maintenance requirements compared to other treatment technologies, and they can provide additional ecosystem services. The technology has been successfully implemented in both developed and developing countries.

The first IWA Scientific and Technical Report (STR) on Wetland Technology was published in 2000. With the exponential development of the technology since then, the generation of a new STR was facilitated by the IWA Task Group on Mainstreaming Wetland Technology. This STR was conceptualized and written by leading experts in the field. The new report presents the latest technology applications within an innovative planning framework of multi-purpose wetland design. It also includes practical design information collected from over twenty years of experience from practitioners and academics, covering experiments at laboratory and pilot-scale up to full-scale applications.

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