

Operation and effluent quality of a small rural wastewater treatment plant (WWTP) receiving discharges from an abattoir WWTP

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Abstract

The objective of this study was to evaluate the impact of effluent and sludge discharges of an abattoir wastewater treatment plant (WWTP) on the operation of a municipal aerated pond WWTP. Experiments were carried out in Cervera WWTP, located in north-eastern Spain, which comprises four ponds operating in series. Cervera WWTP treats a flow rate of 3 100 m³/d of urban sewage mixed with the effluent and the sludge discharged by an abattoir WWTP. Prior to September 1993, the effluents of Cervera WWTP showed poor quality (70 mg TSS/ℓ and 58 mg BOD₅/ℓ) because the abattoir sewage was discharged directly into the municipal sewer. Since September 1993, when the abattoir WWTP was established, effluent quality has improved considerably (24 mg TSS/ℓ and 15 mg BOD₅/ℓ). The sludge discharges of the abattoir WWTP into the municipal sewer did not significantly affect effluent quality of Cervera WWTP, even when the TSS and BOD₅ loading rates were 800% and 60% higher than the design loadings respectively. Cervera WWTP clearly had higher sludge production per treated flow (3 to 6 ℓ/m³ with a percentage of dry matter of 4.8 to 6.8%) than other similar WWTPs. In conclusion, sludge discharge to WWTPs with high retention times to allow for sedimentation and high capacity for storing does not affect effluent quality. However, these discharges increase sludge management costs.

Keywords: operation and maintenance, abattoir wastewater, aerated ponds, waste stabilisation ponds

Introduction

Catalonia (north-eastern Spain) currently has 23 urban wastewater pond systems in operation under the supervision of the Catalan Water Agency (Departament de Medi Ambient, 2001). Altogether these wastewater treatment plants (WWTPs) receive a load equivalent to wastewater from approximately 160 000 inhabitants (1.3% of the total load of the region) and most of these are aerated ponds. To assess the potential of pond systems as an economic and technically viable alternative for wastewater treatment in the rural areas of Catalonia, an evaluation of the existing pond systems was conducted in 1997-1998. The evaluation included a description of the facilities of each WWTP, an analysis of the available performance data, and an evaluation of complementary data and information obtained from additional sampling surveys (García et al., 2000).

All the pond systems currently operating in Catalonia have been constructed over the last 17 years. Agriculture and cattle-raising are the main economic activities in the areas served by ponds. Aerated ponds are used for small to medium-sized communities (1 200 to 16 000 inhabitants, 230 to 4 700 m³/d; note that these flows may include industrial effluents), while stabilisation ponds are used for small communities (90 to 2 800 inhabitants, 20 to 800 m³/d). Most of the pond systems comply with the

European Union standards contained in Directive 91/271 (Council of the European Communities, 1991), despite the inadequate level of operation and maintenance (O & M) often applied to these types of facilities. Aerated ponds produce effluents with a better quality than stabilisation ponds in terms of TSS and BOD₅ (average effluent TSS and BOD₅ of 31 mg/ℓ and 22 mg/ℓ for aerated ponds, and 100 mg/ℓ and 67 mg/ℓ for stabilisation ponds respectively; note that the effluent BOD₅ of the stabilisation pond systems is analysed using raw samples, while the European Union standards state that the stabilisation pond effluents should be analysed using filtered samples).

Aerated ponds require a significant energy supply per treated water volume (0.25 to 1.62 kWh/m³). High electricity consumption in many of the WWTP is mainly due to the lack of dissolved oxygen (DO) control devices, which require continuous operation of the aeration systems. On the other hand, the ratio of water surface to population equivalent (p-e) is clearly lower for aerated ponds (1.3 m²/person-equivalent (p-e)) than for stabilisation ponds (9.6 m²/p-e). Aerated ponds produce much larger amounts of sludge than stabilisation ponds. Furthermore, during the evaluation it was observed that some aerated ponds received sludge from industrial WWTP (mainly from the abattoir), which discharged into the municipal sewer. This obviously increases the necessary sludge-wasting activities and O & M costs. A specific study was carried out to evaluate the impact of effluent and sludge discharges of an abattoir WWTP into the municipal sewer and its influence on the operation and the effluent quality of a small municipal aerated pond system.

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