



## Sludge dewatering and stabilization in drying reed beds: Characterization of three full-scale systems in Catalonia, Spain

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### ABSTRACT

Optimization of sludge management can help reducing sludge handling costs in wastewater treatment plants. Sludge drying reed beds appear as a new and alternative technology which has low energy requirements, reduced operating and maintenance costs, and causes little environmental impact. The objective of this work was to evaluate the efficiency of three full-scale drying reed beds in terms of sludge dewatering, stabilization and hygienization. Samples of influent sludge and sludge accumulated in the reed beds were analysed for pH, Electrical Conductivity, Total Solids (TS), Volatile Solids (VS), Chemical Oxygen Demand, Biochemical Oxygen Demand, nutrients (Total Kjeldahl Nitrogen (TKN) and Total Phosphorus (TP)), heavy metals and faecal bacteria indicators (*Escherichia coli* and *Salmonella* spp.). Lixivate samples were also collected. There was a systematic increase in the TS concentration from 1–3% in the influent to 20–30% in the beds, which fits in the range obtained with conventional dewatering technologies. Progressive organic matter removal and sludge stabilization in the beds was also observed (VS concentration decreased from 52–67% TS in the influent to 33–69% TS in the beds). Concentration of nutrients of the sludge accumulated in the beds was quite low (TKN 2–7% TS and TP 0.04–0.7% TS), and heavy metals remained below low threshold concentrations. *Salmonella* spp. was not detected in any of the samples, while *E. coli* concentration was generally lower than 400 MPN/g in the sludge accumulated in the beds. The studied system demonstrated a good efficiency for sludge dewatering and stabilization in the context of small remote wastewater treatment plants.

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### 1. Introduction

Sewage sludge is the main organic waste or by-product generated in wastewater treatment plants (WWTPs). In general it has total solids concentration around 1–3%, depending on the treatment process (De Maesseneer, 1997). Although sludge production represents only 1–2% of the volume of wastewater treated, its management is highly complex and accounts for 20–60% of the total operating costs of WWTPs (Clevenson et al., 2007). For this reason, sludge management is a matter of concern in many countries, especially if sludge production is expected to increase in the next years as a result of the implementation of new WWTPs (Clevenson et al., 2007). Therefore, optimization of sludge management becomes a key element to reduce WWTPs costs.

Taking into account that sludge moisture is typically as high as 97–99%, a first approach for its management is to decrease the

volume by means dewatering processes, reducing in this way sludge disposal costs and environmental risks associated. A major problem of conventional sludge treatment and dewatering technologies is that they are costly and high energy demanding. The refore, conventional technologies are not often feasible in small WWTPs (<2000 population equivalent (PE)). In this case waste sludge is usually stored in lagoons and drying beds (Obianka-Pemphorwik et al., 2003) or it is transported to the nearest WWTP with a conventional sludge treatment line. In this context, sludge drying reed beds appear as a new and alternative technology, which has low energy requirements, reduced operating and maintenance costs, and causes little environmental impact.

Sludge drying reed beds are based on constructed wetlands (CWs), which are being used for wastewater treatment in many regions of the world (Castellnou-Chorio et al., 2007). CWs are land-based treatment systems that reproduce self-cleaning processes that occur in natural wetlands. Sludge drying reed beds consist of shallow tanks filled with a gravel layer and planted with emergent rooted wetland plants such as *Phragmites australis* (common reed) (Cole, 1998). During last 30 years this technology has been successfully used and improved especially in Denmark

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# Fundamental Aspects Of Sludge Characterization And Dewatering

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