

Rethinking natural, extensive systems for tertiary treatment purposes: The high-rate algae pond as an example

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ABSTRACT

The central element of the 60 m³/d wastewater treatment plant (WWTP) of the campus of the Hassan II Institute of Agronomy and Veterinary Sciences (IAV) in Rabat is a high-rate algae pond (HRAP). This unit functions behind a two-step upflow anaerobic reactor (pre-treatment) and is followed by one maturation pond (MP) for polishing. The system totalizes a hydraulic retention time (HRT) of 9 d with a removal efficiency of the pre-treatment alone exceeding 80% of COD and 90% of TSS. Used in this configuration, the HRAP loses its BOD removal activity and becomes a strictly tertiary treatment unit increasing therefore its nutrients and pathogens removal capabilities. As such, the HRAP removes 85% of total N and 63% of total P. The filtered effluent has 35, 8.3 and 2.7 mg/L respectively for BOD₅, TKN, and total P. Removal of N is due to algae uptake (46%) and ammonia stripping (54%). Data analysis indicates that dinitrification only plays an insignificant or even no role at all. P removal is due to algae uptake and to phosphorus salts precipitation (around 50% each). Fecal coliforms (FC), removal in the HRAP is 1.23 log units with no helminthes eggs found in the effluent. Cumulated FC removal in the whole treatment line (pre-treatment/HRAP/maturation pond) could reach 4 log units in the hot season and often lies between 2 and 3 in the cold season.

Keywords: Two-step upflow anaerobic reactor (TSUAR); High-rate algae pond; Nutrients; Fecal coliforms; Ammonia stripping; Phosphate precipitation
