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FULL-SCALE APPLICATION OF MABR TECHNOLOGY FOR UPGRADING AND RETROFITTING AN EXISTING WWTP: PERFORMANCES AND PROCESS MODELLING

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Abstract

MABR (Membrane Aerated Biofilm Reactor) consists in an attached-growth process in which a gas permeable membrane is used as a biofilm carrier, and bubble-less oxygen transfer allows for a counter-diffusional mechanism where the electron donor (NH_4^+, biodegradable organics) and electron acceptor (O_2) reach the biofilm from opposing sides. The paper reports results form the largest MABR installation in the world, demonstrating the beneficial impact of the technology in terms of improved process resilience under different operational conditions, through the key performance indicator oxygen transfer rate (OTR), which ranged between 7 and 16 $gO_2/m^2/d$. The OTR monitoring over the considered operational period shows (i) a weak impact of sludge temperature on the oxygen transfer within the considered range (9-22 degC) and also (ii) proves the reliability of OTR as an indicator of the improved resilience of the entire wastewater plant in the new MABR configuration, under peak loading conditions. Finally, a mathematical model was developed in the BioWin software platform, to evaluate its use as support tool for model-aided process optimization. The model was calibrated in terms of hydrodynamic behaviour of the MABR zone and seeding effect on the nitrifying biomass, which was expressed as solids retention time (SRT) of the attached growth biomass; the calibrated mathematical tool was then successfully validated in terms of prediction of ammonia concentration in the MABR zone.

Keywords: modelling, Membrane Aerated Biofilm Reactor (MABR), resilience, upgrading

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