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Published in:
Book of Abstracts Sustain 2017

Publication date:
2017

Document Version
Publisher's PDF, also known as Version of record

Simple control rules for mitigating N_2O emissions in phase isolated full-scale WWTPs

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Nitrous oxide (N_2O) is a strong greenhouse gas (GHG) and ozone depleter, with a warming potential 300 times higher than carbon dioxide (CO_2). 1.2% of the total antrophopogenic N_2O emission is believed to originate from the wastewater treatment (WWT) sector. Conventional biological nutrient removal processes are known to produce N_2O. A one year long-term study of N_2O production and emissions was performed at Lynetten, Denmark's largest WWTP. Nitrification and denitrification takes place in 20 interconnected surface aerated reactors by alternating process conditions as well as influent and effluent flows. The long-term data revealed that N_2O emissions accounted for up to ~30% of the total CO_2 footprint of the WWTP. The highest production and emission of N_2O was occurring during nitrification phases. High ammonium concentrations and long aeration phases lead to high net N_2O production and emissions rates. High production and emissions were also associated with the afternoon loading peaks at the WWTP. During denitrification phases, N_2O was initially produced and consumed before onset of aeration. An effective control strategy was implemented, whereby N_2O emissions were reduced from 0.8% to 0.3% of the nitrogen load during the mitigation period. By applying this simple control strategy the overall CO_2 footprint was reduced in 18% compared to normal operation.

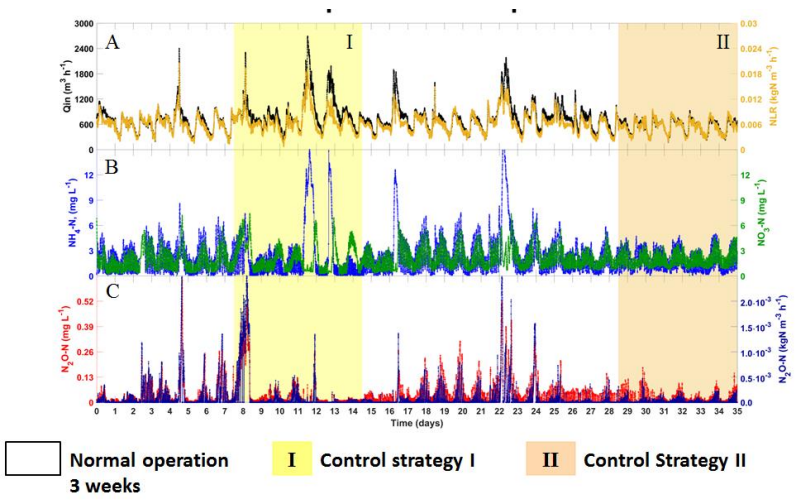

Figure 1: Performance of the Lynetten WWTP during normal operation and evaluation of control strategies.