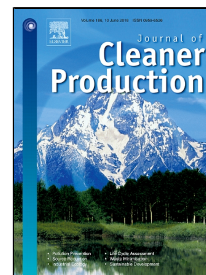


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Critical analyses of nitrous oxide emissions in a full scale activated sludge system treating low carbon-to-nitrogen ratio wastewater

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Abstract: A critical analysis of nitrous oxide emissions in a full-scale modified Ludzack Ettinger plant treating municipal wastewater with low carbon to nitrogen ratio is presented. The results of N₂O emissions were processed by coupling classical (liquid chemical/physical characterization) and new data analytics techniques (online gaseous emissions and statistical analysis). Correlation between the operational parameters of the plant and long-term online monitored nitrous oxide emissions was conducted. The analysis considered the effect of off-gas sampling methods, the variability of feeding characteristics and the main liquid process variables as the principle parameters that may affect nitrous oxide emissions. In order to detect and assess the causal relationships between online monitored system variables and nitrous oxide emissions, statistical and event-based sensitivity analysis was adopted to identify causal relationships between the variables of the system. Observations revealed that lower ratio between carbon and nitrogen (COD:N) resulted in higher N₂O emissions. The average nitrous oxide emission factors changed from 0.0089 gN₂O/kgTN_{in} to 0.051 gN₂O/kgTN_{in}, that corresponded to denitrification limited by organic carbon availability. The nitrous oxide dynamics were not significantly influenced by dissolved oxygen variations (within the range of 1.5 – 2 mg/L). However daily peaks of nitrous oxide emissions occurred when aeration flow-rate resulting was higher and stripped more nitrous oxide from liquid.

Keywords: Nitrous oxide emissions, Full-scale monitoring, Activated sludge, Sensitivity analysis; Gas sampling assessment, Emission Factors

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