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EFFECT OF CARBON DOSING ON DENITRIFICATION IN AN AERATED CONSTRUCTED WETLAND RECEIVING HIGH HYDRAULIC LOAD

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Dow has identified six manufacturing locations as key water stressed sites and has committed to reducing their freshwater intake intensity by 20% in 2025 as compared to 2015 through enhancing water reclamation and reuse. Dow Terneuzen (The Netherlands), for Dow's second largest production site, about 22 million m^3/y of fresh water is needed at present, of which 75% already comes from Local and circular sources. However, still about 4-5 million m^3/y comes from a potable water source which Dow aims to replace by reuse of its own industrial wastewater treatment plants effluents, rain water collected at Dow's terrain and the effluent from the municipal wastewater treatment plant of Terneuzen. To end this, aerated wetland technology was tested to further polish the abovementioned effluents in order to provide biologically stable water for further treatment in a membrane/ion exchange installation intended to produce demineralized water. The wetlands are operated at high hydraulic loading rates (0.69 $m^3/m^2/d$) and proved to be effective for nitrification, but denitrification was limited because of an unfavorable C/N ratio, especially for the municipal treatment plant effluent. Hence, further research was carried out on aerated wetland by applying an artificial carbon dosing using municipal effluent only.

The study was conducted in an outdoor pilot-scale (12.5×28×1m) horizontal subsurface flow constructed wetland located at the site of Dow (Terneuzen, The Netherlands), filled with expanded clay aggregates (Argex™) and planted with common reed *(Phragmites australis)*. The CW was divided into three equal imaginary zones and forced bed aeration (FBA) was provided at the bottom of each zone. Dissolved oxygen concentrations in each zone was monitored and controlled by LDO sensors and programmable logic controller (PLC). CW was fed at a hydraulic loading rate of 0.69 $m^3/m^2/d$ with HRT 12 hours. A NITRATAX sensor was kept at the end of first zone to monitor the nitrate concentration. Different carbon dosages i.e. COD/N = 0, 2.0, 3.5 and 4.0 were applied at the start of zone 2 and aeration was switched off in the middle zone of the wetland to create the anoxic environment. However, zone 1 and 3 were aerated (2-3 mgO_2/L) respectively for nitrification and to degrade the extra C-source washout if any. Nitrification as usual remained optimal (~100 %) during whole experiment. The average removal of total nitrogen (TN) was recorded as 23%, 34%, 48% and 59% versus COD/N ratio of 0, 2.0, 3.5 and 4.0 respectively. Moreover, no C-source washout was observed at the outlet.

BIO: Hafiz Khan is a PhD student at Ghent University (Campus Kortrijk), Belgium and working on intensified wetlands. He is currently focusing on pilot scale intensified wetlands at Dow industries (Terneuzen, the Netherlands).

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