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AERATED WETLANDS AS PRETREATMENT FOR MILD DESALINIZATION PROCESS AT DOW TERNEUZEN

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Introduction

Reuse of water has a high priority in the chemical industry. Dow Chemicals Terneuzen produces more than 800 various chemicals and plastics and annually uses 22 million m³ fresh water from a water stressed delta. Currently, 75% of Dow's water supply originates from sustainable sources by enhancing water reclamation and reuse. To reduce their water footprint, Dow collaborates with Evides Industriewater to develop an alternative for the remaining 4-8 mil m³/yr. The local water source for this comprises a combination of rainwater collected from the Dow premises and its periphery, Dow treated wastewater (cfr. Biox) and municipal treated wastewater from the Terneuzen WWTP. An aerated wetland, based on the Forced Bed Aeration™ principle, serves as pretreatment and is followed by a mild desalination process (UF-IX-RO). The wetland aims to provide a biologically stable effluent, thereby decreasing biofouling of membranes and reducing the use of energy and chemicals for desalination. The pilot consists of two HSSF (horizontal subsurface flow) CW of 350 m² each (28m x 12.5m), which were each fed with 10 m³/h of municipal effluent from WWTP Terneuzen and effluent Biox from Dow. Both pilot cells are filled with LECA and are aerated in three separate zones, by means of blowers, connected to aeration grids at the bottom of the wetland cells. Assuming a substrate porosity of 35%, the hydraulic retention time in each wetland cell is 12h. The water flows horizontally through the filter material, that is planted with *Phragmites australis.* One of the cells contains a zone where biochar was mixed with the LECA to enhance removal of emerging pollutants.

Monitoring

The data collection on flow rates, oxygen levels, nitrogen and ammonium was done automatically with in-line sensors, and supplemented with an intensive grab sample and analysis program. Different operational configurations were tested that impact the performance of the aerated wetland: dissolved oxygen concentration, hydraulic retention time 12h or 24h (HRT) and carbon dosing. Next to that the the effect of the biochar addition was monitored. A DO concentration of 2-3mg/L turned out to be required for COD (influent 25mgO_2/L) removal in the first third of the wetland. COD removal ranges between 20-30% depending on season and HRT. NH_4^+ was completely nitrified in the first third of the wetland, so aeration of the rest of the wetland proved to be superfluous. The removal rate of TN was influenced by the higher temperature during summer (52% vs 13%) and carbon dosing (C:N 1=21% vs C:N 4=62.9%). However, based on cost calculations, it was more economical to remove NO_3 by IX compared to supplying a carbon source to the wetland. This research also showed that the UF permeability remains consistently higher when a wetland is used as pretreatment which confirms that the aerated wetland provides a biological stable effluent. This also has been illustrated by biofilm growth experiments.

BIO of Presenter (50-word maximum): Dion van Oirschot has been the director for Rietland since 1994 and has designed and constructed hundreds of wetlands, mainly in the Netherlands and Belgium, but also in China and the Middle East. The past decade he has focused on aerated wetlands (forced bed aeration) and (co-)authored several articles on that topic. Rietland is a member of Global Wetland Technology.