



**MASTER THESIS PROJECT**

**Occurrence and removal of antibiotics from domestic  
wastewater in a Danish full-scale constructed wetland  
system**

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## Abstract

In recent years, implementation of constructed wetlands (CWs) for the treatment of wastewater contaminated with antibiotics has gained attention due to necessity to prevent the development of antimicrobial resistance genes (ARGs). This study was developed under the umbrella of project NATURE: Nature-based solutions to reduce antibiotics, pathogens and antimicrobial resistance in aquatic ecosystems. The majority of previous studies in the subject of ARG removal took place at the lab-scale level under controlled conditions. This study was aim to explore the occurrence and removal of 14 pre-selected antibiotics from domestic wastewater in full-scale systems. The domestic wastewater and surface was collected in February from different sites across the Denmark for the screening of different nature based solutions (NBS). However, the wastewater from the selected site, Tjørnelunde, Denmark treating combined sewer was monitored twice per month from March to May. All the samples were analyzed by high-performance liquid chromatography coupled to mass spectrometry (LC-MS/MS). Results revealed the presence of Sulfapyridine, Trimethoprim, Sulfadiazine, Sulfamethizole, Sulfamethoxazole, and Roxithromycin at different sampling sites (Vejle, Ørby, Skødstrup, and Nyborgvej). Clarithromycin was the only antibiotic detected every sampling time (March to April) in the inlet of the system, which has been found in higher concentrations than its PNEC value (0.06 µg/L). All of the other antibiotics were below the limit of detection (LOD) or limit of quantification (LOQ) which varied from 0.01 µg/L to 10 µg/L. Clarithromycin removal in the CW system was more than 80%. The occurrence of antibiotics in such smaller towns is less frequent, resulting in lower frequency and concentrations than what is usual found in larger cities. Nevertheless, it can also be seen that a single antibiotic detection shows its presence in levels for which effects in the environment might occur. Removal efficiencies are very promising for a full-scale system. The monitoring work is ongoing and will hopefully be performed for a one year period, at least.

**Keywords:** Nature-base solutions, Antimicrobial, Full-scale constructed wetland, Domestic wastewater