Comammox Nitrospira are abundant ammonia oxidizers in diverse groundwater-fed rapid sand filter communities

Comammox Nitrospira are abundant ammonia oxidizers in diverse groundwater-fed rapid sand filter communities. The recent discovery of completely nitrifying Nitrospira demands a re-examination of nitrifying environments to evaluate their contribution to nitrogen cycling. To approach this challenge, tools are needed to detect and quantify comammox Nitrospira. We present primers for the simultaneous quantification and diversity assessment of both comammox Nitrospira clades. The primers cover a wide range of comammox diversity, spanning all available high quality sequences. We applied these primers to 12 groundwater-fed rapid sand filters, and found comammox Nitrospira to be abundant in all filters. Clade B comammox comprise the majority (≈75%) of comammox abundance in all filters. Nitrosomonadaceae were present in all filters, although at low abundance (mean= 1.8%). Ordination suggests that temperature impacts the structure of nitrifying communities, and in particular that increasing temperature favours Nitrospira. The nitrogen content of the filter material, sulfate concentration and surface ammonium loading rates shape the structure of the comammox guild in the filters. This work provides an assay for simultaneous detection and diversity assessment of clades A and B comammox Nitrospira, expands our current knowledge of comammox Nitrospira diversity and demonstrates a key role for comammox Nitrospira in nitrification in groundwater-fed biofilters.

General information
Publication status: Published
Organisations: Department of Environmental Engineering, Water Technologies, Department of Micro- and Nanotechnology, Surface Engineering, Department of Applied Mathematics and Computer Science, Technical University of Denmark
Corresponding author: Smets, B. F.
Pages: 1002-1015
Publication date: 2018
Peer-reviewed: Yes

Publication information
Journal: Environmental Microbiology
Volume: 20
Issue number: 3
ISSN (Print): 1462-2912
Ratings:
BFI (2018): BFI-level 2
Scopus rating (2018): CiteScore 4.96 SJR 2.26 SNIP 1.324
Web of Science (2018): Impact factor 5.147
Web of Science (2018): Indexed yes
Original language: English
Electronic versions:
Fowleretal.2017EMPreprintVersion.pdf. Embargo ended: 21/12/2018
DOIs:
10.1111/1462-2920.14033
Source: FindIt
Source ID: 2394935945
Research output: Contribution to journal > Journal article – Annual report year: 2018 > Research > peer-review