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Published in:

5th NordicRAS Workshop on Recirculating Aquaculture Systems Berlin, Germany, 7-8 October 2019: Book of Abstracts.

Publication date:

2019

Document Version

Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):

Letelier-Gordo, C. O., Aalto, S. L., & Suurnäkki, S. (2019). Hydrogen sulfide production from fish organic waste. In J. Dalsgaard (Ed.), *5th NordicRAS Workshop on Recirculating Aquaculture Systems Berlin, Germany, 7-8 October 2019: Book of Abstracts*. (pp. 45-45). DTU Aqua. DTU Aqua-rapport, No. 350-2019

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Hydrogen sulfide production from fish organic waste

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Abstract

The production of hydrogen sulfide (H₂S) has become a new challenge in marine land-based recirculating aquaculture systems (RAS). H₂S is a toxic gas that causes massive fish mortality even at low concentrations, and additional serious odour problems in the surroundings. It is a bacterial by-product originating from the degradation of organic matter in sulfur-rich waters e.g. marine waters with sulfate concentrations.

In order to develop methods to hinder H₂S production in marine land-based RAS, more information on the H₂S production conditions and microbiology is needed. This study followed the production of H₂S from rainbow trout (*Oncorhynchus mykiss*) organic waste under different salinities (0, 5, 10, 15, 25 and 35 ppt) in anaerobic mixed reactors, and examined the microbial community as well as abundance of sulfate reducing bacteria (SRB).

The results showed that H₂S formation increased with salinity, the maximal concentration being 23.1 ± 8.2 mg H₂S/L at 0 ppt and 153.9 ± 34.1 mg H₂S/L at 35 ppt. Similarly, the H₂S production rates increased from 5.6 ± 0.2 to 26.4 ± 12.7 mg of H₂S produced per day with increasing salinity. The H₂S concentrations normalized with total chemical oxygen demand (TCOD) ranged between 0.76 - 7.21 mg H₂S per gram of TCOD, being significantly lower in 0 ppt treatment than in higher salinities, where no differences were found.

The overall microbial community, measured in experiment 2, changed gradually in time and between salinities, phyla Fusobacteria and Bacteroidetes being more abundant in 35 ppt reactors than in other reactors. The common SRB were found only in 0 and 5 ppt reactors, while in 10 ppt and 35 ppt reactors, H₂S production was driven by novel currently unidentified SRB groups.

The presented study is an important finding contributing to fill up essential knowledge gaps, providing a reliable quantifiable method for H₂S measurements and new information for understanding H₂S production in aquaculture systems.

Acknowledgments: This work originated from the BONUS call 2015: Blue Baltic – BONUS CLEANAQ project, supported by BONUS (Art 185) and funded jointly by the EU and Innovation Fund Denmark.

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