Single-sludge denitrification in recirculating aquaculture systems: effects of pre-fermentation and pH

Single-sludge denitrification (DN) reactors in aquaculture use the carbonous solid fish waste produced in the system to reduce the discharged nitrate load. The solid waste is available for denitrifiers when present in soluble, readily biodegradable form, and the transformation is accomplished by bacterial hydrolysis and fermentation. The objective of this study was to quantify the effect of pre-fermentation of solid fish waste on single-sludge DN reactor efficiency. Pre-fermentation times tested were 0 d (no pre-fermentation), 1 d, 5 d, and 10 d, and the efficiency was quantified as the potential DN rate obtained in laboratory assays. Results showed that the highest DN rate was achieved with 1 d pre-fermentation. The volumetric DN rates measured in decreasing order were 23.4 +/- 0.00 mg NO3-N L-1 h(-1) (1 d), 20.5 +/- 0.35 mg NO3-N L-1 h(-1) (5 d), 17.0 +/- 0.47 mg NO3-N L-1 h(-1) (10 d), and 14.2 +/- 0.24 mg NO3-N L-1 h(-1) (0 d). It was suspected that the poor utilization of soluble COD (sCOD) in the 5 d and 10 d pre-fermentation treatments was due to the low starting pH (pH <7). Subsequently, the experiments were repeated in 0.1 M HEPES buffer (pH = 7.1) and showed a clear correlation between specific DN rate and sCOD content. Overall, the highest increase in potential specific DN rate was achieved by applying pre-fermentation; e.g., from 0 d to 1 d, the increase was 123% and 106% at unadjusted pH and pH 7.1, respectively. An additional 20% increase was achieved at pH 7.1 by prolonging the pre-fermentation time to 5 d.

General information
State: Published
Organisations: National Institute of Aquatic Resources, Section for Aquaculture, Department of Environmental Engineering, Water Technologies
Pages: 1825-1831
Publication date: 2015
Peer-reviewed: Yes

Publication information
Journal: American Society of Agricultural and Biological Engineers. Transactions
Volume: 58
Issue number: 6
ISSN (Print): 2151-0032
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.3 SJR 0.481 SNIP 0.825
Web of Science (2017): Impact factor 1.118
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.29 SJR 0.455 SNIP 0.837
Web of Science (2016): Impact factor 0.975
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.63 SJR 0.765 SNIP 1.012
Web of Science (2015): Impact factor 0.913
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.23 SJR 0.619 SNIP 0.98
Web of Science (2014): Impact factor 0.895
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.26 SJR 0.62 SNIP 0.897
Web of Science (2013): Impact factor 0.843
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.26 SJR 0.657 SNIP 0.959
Web of Science (2012): Impact factor 0.974
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.3 SJR 0.631 SNIP 0.929
Web of Science (2011): Impact factor 1.033
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.677 SNIP 0.866