The inhibitory impacts of nano-graphene oxide on methane production from waste activated sludge in anaerobic digestion - DTU Orbit (14/01/2019)

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The wide application of graphene oxide nanoparticles inevitably leads to their discharge into wastewater treatment plants and combination with the activated sludge. However, to date, it is largely unknown if the nano-graphene oxide (NGO) has potential impacts on the anaerobic digestion of waste activated sludge (WAS). Therefore, this work aims to fill the knowledge gap through comprehensively investigating the effects of NGO on carbon transformation and methane production in the anaerobic digestion of WAS. Biochemical methane potential tests demonstrated the methane production dropped with increasing NGO additions, the cumulative methane production decreasing by 7.6% and 12.6% at the NGO dosing rates of 0.054 mg/mg-VS and 0.108 mg/mg-VS, respectively. Model-based analysis indicated NGO significantly reduced biochemical methane potential, with the highest biochemical methane potential decrease being approximately 10% at the highest NGO dosing rate. Further experimental analysis suggested that the decreased methane production was firstly related to a decrease in soluble organic substrates availability during the process of sludge disintegration, potentially attributing to the strong absorption of organic substrates by NGO. Secondly, NGO significantly inhibited the methanogenesis by negatively affecting the corresponding enzyme activity (i.e. coenzyme F420), which could also resulted in a decreased methane production.

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering, PROSYS - Process and Systems Engineering Centre, Tongji University
Pages: 1376-1384
Publication date: 2019
Peer-reviewed: Yes

Publication information
Journal: Science of the Total Environment
Volume: 646
ISSN (Print): 0048-9697
Ratings:
BFI (2019): BFI-level 2
Web of Science (2019): Indexed yes
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.98 SJR 1.546 SNIP 1.65
Web of Science (2017): Impact factor 4.61
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.09 SJR 1.652 SNIP 1.856
Web of Science (2016): Impact factor 4.9
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 4.33 SJR 1.653 SNIP 1.648
Web of Science (2015): Impact factor 3.976
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 4.2 SJR 1.635 SNIP 1.843
Web of Science (2014): Impact factor 4.099
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.73 SJR 1.527 SNIP 1.745
Web of Science (2013): Impact factor 3.163
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 3.7 SJR 1.749 SNIP 1.82
Web of Science (2012): Impact factor 3.258
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 3.61 SJR 1.802 SNIP 1.676
Web of Science (2011): Impact factor 3.286
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.651 SNIP 1.506
Web of Science (2010): Impact factor 3.19
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.576 SNIP 1.6
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.461 SNIP 1.489
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.393 SNIP 1.473
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.512 SNIP 1.586
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.439 SNIP 1.509
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.126 SNIP 1.299
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.156 SNIP 1.35
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.175 SNIP 1.359
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.054 SNIP 1.076
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.916 SNIP 1.051
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.897 SNIP 0.934

Original language: English
Keywords: Anaerobic digestion, Biochemical methane potential, Methane production, Methanogenesis, Nano-graphene oxide, Waste activated sludge
DOIs:
10.1016/j.scitotenv.2018.07.424
Source: Scopus
Source-ID: 85050748944
Research output: Research - peer-review ; Journal article – Annual report year: 2019