Biohydrogen production from desugared molasses (DM) using thermophilic mixed cultures immobilized on heat treated anaerobic sludge granules

Hydrogen production from desugared molasses (DM) was investigated in both batch and continuous reactors using thermophilic mixed cultures enriched from digested manure by load shock (loading with DM concentration of 50.1 g-sugar/L) to suppress methanogens. H2 gas, free of methane, was produced during batch cultivations, at different (DM) concentrations ranging from 1.5 g-sugars/L to 50.1 g-sugars/L. The highest yield of 237 ml-H2/g-sugar was achieved during the DM batch fermentation at concentration of 2.1 g-sugars/L, whereafter the yield decreased with increasing DM concentration. The enriched hydrogen producing mixed culture achieved from the 16.7 g-sugars/L DM batch cultivation was immobilized on heat treated anaerobic sludge granules in an up-flow anaerobic sludge blanket (UASB) reactor. The UASB reactor, operated at a hydraulic retention time (HRT) of 24 h fed with 16.7 g-sugars/L DM showed good performance with a satisfactory hydrogen yield of 269.5 ml-H2/g-sugar and rate of 4500 ml H2/l⋅d. Fluorescent in situ hybridization (FISH) analysis of the microbial community of sludge from batch fermentation and the UASB-granules after 54 days of operation, was dominated by Thermoanaerobacterium spp., which are key players in fermentative hydrogen production of DM under thermophilic conditions. Furthermore, the granules in the UASB reactor were also significantly containing Thermoanaerobacterium spp. and phylum Firmecutes (most Clotridium, Bacillus and Desulfobacterium) and Thermoanaerobacterium thermosaccharolyticum with a relative abundance of 36%, 27%, and 10% of total microorganisms, respectively. This study shows that hydrogen production could be efficiently facilitated by using anaerobic granules as a carrier, where microbes from mixed culture enriched in the DM batch cultivation were immobilized on, in an UASB reactor.

General information
State: Published
Organisations: Department of Environmental Engineering, Residual Resource Engineering
Contributors: Kongjan, P., O-Thong, S., Angelidaki, I.
Pages: 14261-14269
Publication date: 2011
Peer-reviewed: Yes

Publication information
Volume: 36
Issue number: 21
ISSN (Print): 0360-3199
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.1 SJR 1.116 SNIP 1.267
Web of Science (2017): Impact factor 4.229
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.74 SJR 1.145 SNIP 1.315
Web of Science (2016): Impact factor 3.582
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.46 SJR 1.27 SNIP 1.314
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 3.54 SJR 1.207 SNIP 1.484
Web of Science (2014): Impact factor 3.313
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 3.38 SJR 1.265 SNIP 1.449
Web of Science (2013): Impact factor 2.93
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes