Environmental Engineering and Management Journal

March 2012, Vol.11, No. 3, Supplement, S82
http://omicron.ch.tuiasi.ro/EEMJ/

"Gheorghe Asachi" Technical University of Iasi, Romania

P92

A STUDY ON THE INFLUENCE OF ACTIVATED SLUDGE AS NITROGEN SOURCE ON HYDROGENIC BATCH DARK FERMENTATION OF THE ORGANIC SOLID WASTE

C. Escamilla-Alvarado[1], M.T. Ponce-Noyola[2], H.M. Poggi-Varaldo[*1]

[1]Environmental Biotechnology and Renewable Energies R&D Group, Dept. of Biotechnology and Bioengineering, CINVESTAV del IPN, Mexico D.F., 07000, Mexico, Phone.: 5255 5747 3800 ext 4324; [2]Microbial Genetics Group, Ibidem; e-mail : hectorpoggi2001@gmail.com

Abstract

Biohydrogen is considered a feasible option for decreasing oil dependence, and in turn, biomass from municipal wastes is a promising feedstock for its production. Carbon to nitrogen (C/N) ratio of municipal organic wastes is usually high, up to 76, yet for anaerobic fermentation the suggested C/N ratio is 25-35. Nitrogen may be supplemented as ammonia or in the form of organic nitrogen, such as manure, waste sludges, or food wastes. This research studied the addition of non sterile activated sludge as inexpensive an easily available nitrogen source for hydrogen production of organic residues.

Batch, solid substrate anaerobic hydrogenogenic fermentation intermitently vented mini reactors (SSAHF-IV) were used for organic nitrogen and alkalinity supplementation studies on a 2^3 experimental design basis. Factors were temperature (35, 55 ºC), C/N ratio (basal 50, 30 adjusted with activated sludge), and alkalinity (none, 0.06 g $CaCO_3$/g dry substrate with phosphate salts). Glass mini-reactors were operated as described elsewhere.

During the first cycle of operation cumulative hydrogen production (P_{H2}) and maximum hydrogenic rate (R_{H2}) were higher in thermophilic regime than mesophilic one. No lag phase was observed: at 14 h most mini-reactors had hydrogen contents superior to 30%. Highest results were P_{H2} = 1575 μmol_{H2}/gVS and R_{H2} = 68.3 μmol_{H2}/gVS/h in the thermophilic mini-reactor with no addition of alkalinity nor sludge. Controls did not show significant hydrogen production.

Sludge and alkalinity supplementation unexpectedly did not have a positive effect on P_{H2} in any of the regimes. The C/N of OFMSW was sufficient to produce high amounts of hydrogen (P_{H2} = 1575 $umol_{H2}$/gVS, R_{H2} = 68.3 $umol_{H2}$/gVS/h). This may infer that microorganisms introduced through supplemented sludge may have affected fermentation, particularly boosting hydrogen consumption. On the other hand, after bioreactor headspace flushing with N_2, there was a second cycle of hydrogenesis in thermophilic units, but not in mesophilic ones. Gas sparging has been used previously with other substrates and 2 to 5 cycles of hydrogenesis have been obtained. Despite the few or inexistent multiple cycles, our hydrogen productions were comparable to those in literature of SSAHF-IV. It is very likely that there would be a maximum of hydrogen that might be harvested independently of the cycles.

Key words: intermittent venting; municipal organic solid wastes; nitrogen supplementation