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INFLUENCE OF THE TYPE OF ALKALI USED FOR PH CORRECTION OF ACID GROWTH MEDIA ON METHANE PRODUCTION BY ACETOCLASTIC METHANOGENS

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Abstract

In recent years the biological production of hydrogen and methane from organic waste and effluents in two-stage anaerobic systems has received increasing attention. The anaerobic digestion of the broth resulting from dark fermentation for hydrogen production does not always run smoothly. A critical point in methane production, when starting from a substrate already utilized for hydrogen production, is the adaptation of the methanogenic consortia to peculiar substrate conditions. In fact the organic waste used for hydrogen production has usually low pH values, due to the need to selectively favour the hydrogen producers. Moreover, high levels of volatile fatty acids (VFA) accumulate during fermentation, with a further lowering of pH. As methanogenic consortia are negatively affected by low pH values, it is necessary to provide for pH correction. The kind of alkali used to correct the pH of the broth has been invoked as a possible source of sluggish digestions sometimes observed in the methanogenic phase of the two-stage process.

In this research we monitored the activity of a selected methanogenic acetoclastic consortium in a synthetic medium of composition mimicking that of a broth resulting from hydrogen fermentation. In particular, the phosphate-buffered basal medium (PBBM) for acetoclastic methanogens was modified by addition of a mixture of VFA and ethanol. The resulting pH value, equal to 4.21, was adjusted to 7 by means of different alkali: NaOH, KOH and $NaHCO_3$. These media were compared with a medium having unadjusted pH or with a classic PBBM at pH 7. Gas production (volume and composition) was monitored during the incubation period (2 months at 35°C, in 100-mL reactors).

For all treatments, an initial lag-phase was observed, due either to the reduced inoculum amount (5%, v/v) or to the need for the methanogenic consortium to adapt to the new growth medium conditions. Methane production was earlier and higher when the pH of the growth medium had been adjusted with $NaHCO_3$. Sodium bicarbonate, together with CO_2, is usually utilized as a buffering agent in growth media for methanogens, where it allows for neutral conditions to be maintained. The positive effect that it showed in this experiment can be attributed to this buffering function. As no methane production was detected in the medium with unadjusted pH, pH correction seems necessary for methane production from broths resulting from hydrogen production. From a technical point of view, pH adjustment with Na bicarbonate is preferable than pH adjustment with soda.