P68. Microaeration in anaerobic digestion systems: effect of low oxygen concentrations on methanogenic communities

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In anaerobic digestion (AD) systems, the coordinated activity of different microbial groups leads to the conversion of complex organic matter into methane. The presence of oxygen may cause negative effects on these processes, by inhibiting the growth and activity of obligate anaerobes, namely methanogens. Nevertheless, the exposure to small amounts of oxygen (microaeration) was shown to improve the AD processes, mainly by enhancing the activity of facultative bacteria. These bacteria promote the hydrolysis and fermentation of the organic macromolecules into various intermediates, using oxygen as final electron acceptor, thus increasing the availability of substrates for syntrophic bacteria and methanogens. The effect of low oxygen concentrations towards these two microbial groups has been seldom studied and was investigated in this work. For that, anaerobic sludge was incubated in batch bottles with acetate, H_2/CO_2 or ethanol until reaching the exponential growth phase. Then, second substrate addition was performed and oxygen was added at increasing concentrations (0, 0.5, 1.0, 2.5 and 5%). Compared with the controls (0% O_2), O_2 exposure significantly decreased the substrate consumption and initial methane production rate (MPR) from H_2/CO_2 or acetate, at all the concentrations tested. At 0.5% O_2, MRP from these two substrates was inhibited by 31±5% and 39 ±10%, respectively. Nevertheless, the assays amended with acetate were incubated over 30 hours, and activity was recovered in the assays that received the lower % O_2. In the assays with ethanol, significant effects on ethanol uptake, acetate production and MPR were only observed at 2.5% and 5% O_2. At 2.5%, MRP inhibition was 36±7%. The lower impact of O_2 in these assays may be related to stimulation of facultative bacteria by the presence of ethanol, that enhanced O_2 removal from the media, allowing the methanogenic community to maintain its activity.

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