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A mass diffusion-based interpretation of the effect of total solids content on solid-state anaerobic digestion of cellulosic biomass

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Abstract

In solid-state anaerobic digestion (SS-AD) of cellulosic biomass, the volumetric methane production rate has often been found to increase with the increase in total solids (TS) content until a threshold is reached, and then to decrease. This phenomenon cannot be explained by conventional understanding derived from liquid anaerobic digestion. This study proposed that the high TS content-caused mass diffusion limitation may be taken responsibility for the observed methane production deterioration. Based on this hypothesis, a new SS-AD model was developed by taking into account the mass diffusion limitation and hydrolysis inhibition. The good agreement between model simulation and the experimental as well as literature data verified that the observed reduction in volumetric methane production rate could be ascribed to hydrolysis inhibition as a result of the mass diffusion limitation in SS-AD.