Insights into the methanogenic degradation of *N*, *N*-dimethylformamide: the functional microorganisms and their ecological relationships

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ABSTRACT The methanogenic degradation of *N*, *N*-dimethylformamide (DMF) was investigated using anaerobic digested sludge (ADS), aerobic activated sludge (AAS) and co-cultured sludge (CCS), respectively. Both the metabolic pathway and the corresponding microorganisms which function in the methanogenic degradation of DMF were elucidated. DMF was unable to be degraded anaerobically by ADS due to the lack of DMF-hydrolyzing bacteria. DMF can be effectively degraded by AAS, however, no methane was recovered under the aerobic condition. The co-culture of DMF-hydrolyzing bacteria and methanogens in the CCS allowed for both hydrolysis of DMF and methane production to proceed successfully under the anaerobic condition, realizing the complete conversion from DMF to methane. However, a niche overlap due to the competition for the intermediates lowered the abundance of DMF-hydrolyzing bacteria. The introduction of nitrate, timely replenishment of AAS, micro-aeration and co-digestion were likely to maintain a high abundance of DMF-hydrolyzing bacteria to ensure an effective hydrolysis.

Keywords: *N*, *N*-dimethylformamide; anaerobic digestion; microbial community; ecological relationship; competition; hydrolysis

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