Modulation of butyrate-degrading methanogenic communities by conductive materials

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Butyrate is a volatile fatty acid commonly present in anaerobic bioreactors. Previous research showed that methane production (MP) rates from butyrate, by lake sediment microbiomes, doubled by addition of carbon nanotubes, which was accompanied by changes in the microbial community composition, with enrichment of typical fatty-acid degrading bacteria (*Syntrophomonas* spp.), well known to exchange electrons with methanogens via hydrogen or formate formation (1). But the authors suggested that electrons exchange via conductive materials (CM) may take place instead.

In our study, anaerobic butyrate-degrading enrichment cultures were developed with other CM, namely activated carbon (AC) and magnetite (Mag) at 0.5 g/L. MP started earlier in AC enrichment and complete degradation was achieved faster in Mag enrichment. *Syntrophomonas* spp. were enriched in all cultures (representing 60 to 80 % of the total bacterial community), but hydrogenotrophic methanogens were highly stimulated by AC (78 % of *Methanomicrobiales*), while the methanogenic community of Mag culture was more diverse in acetoclastic methanogens (43% of *Methanosarcina* and *Methanosaeta*). It is still unclear if the improvement on butyrate degradation is associated to the role of CM in interspecies electron transfer, but it is undoubtful that they differentially modulate the methanogenic communities towards faster MP.

References

(1) Zhang, W., Zhang, J. & Lu, Y. Stimulation of carbon nanomaterials on syntrophic oxidation of butyrate in sediment enrichments and a defined coculture. *Sci. Rep.* **8**, 12185 (2018).

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