Pure cultures of hydrogenotrophic methanogens are affected by modified activated carbons, zeolite, sand and glass beads

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The metabolism of hydrogenotrophs has been showed to be improved in the presence of carbon nanotubes, which is relevant since they are crucial microorganisms in the conversion of waste to methane (1). In this study, we investigated if other materials, with different physicochemical properties, also affect the hydrogenotrophic activity of *Methanobacterium formicicum*.

M. formicicum was incubated separately with 0.5 g/L of sand, and commercial zeolite, glass beads and activated carbon (AC0) with and without modifications on the AC0 surface. Modifications were obtained by chemical oxidation with HNO_3 (AC_HNO_3), H_2SO_4 (AC_ H_2SO_4) or both (AC_HNO_3_ H_2SO_4) and thermal treatments.

All materials, with exception of AC_HNO_3_ H_2SO_4, improved the methanogenic activity. Carbon-based materials significantly reduced the lag phases preceding methane production (MP) (from approximately 5 days in the control to circa 1 day). Zeolite, sand and glass beads also reduced the lag phases but less than carbon materials (i.e., from 5 days to 1.5, 2.7 and 3.5 days, respectively). Additionally, exponential MP rates were up to 1.5 times higher in the assays with non-carbon materials.

All materials tested have different physical/chemical properties including conductivities, but all stimulated the methanogenic activity. Thus, further studies are necessary to identify the mechanisms behind the underlying observations.

References

(1) Salvador, A. F. *et al.* Carbon nanotubes accelerate methane production in pure cultures of methanogens and in a syntrophic coculture. *Environ. Microbiol.* **19**, 2727–2739 (2017).

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