Efficient Atmospheric Methane Removal by Methanotrophic Bacteria Immobilized on Porous Building Materials

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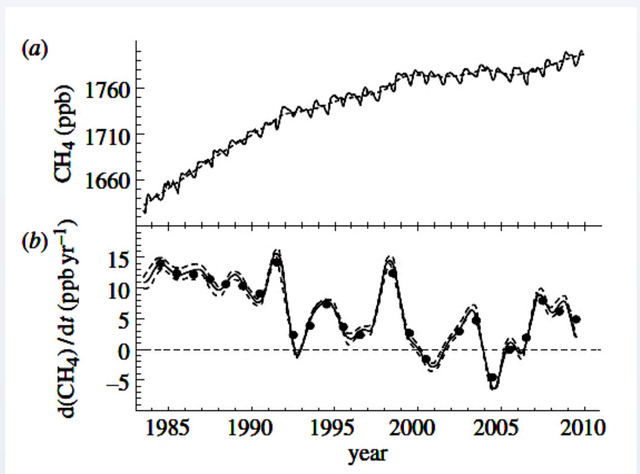
Research Background

- Methane is a greenhouse gas with increasing atmospheric concentration caused by anthropogenic emission
- Rumen fermentation and automobile exhaust in the urban areas account for >50 % of the total anthropogenic methane emission



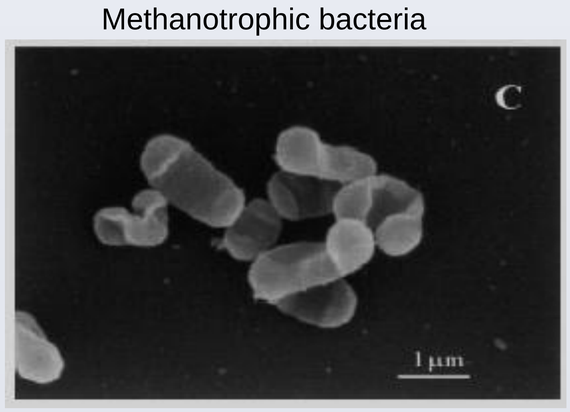
Dlugokency et al, 2012

Problem statement:

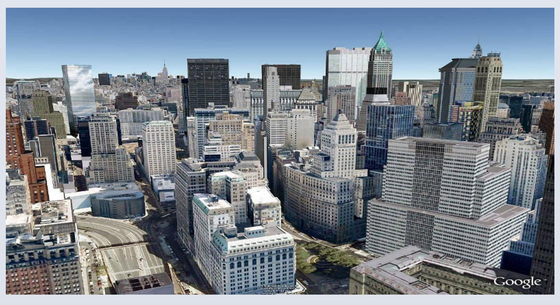
Increasing methane emission from the animal house and urban areas due to the increasing global population

- Biological treatment using **methanotrophic bacteria (MOB)** is the best solution to mitigate anthropogenic methane emission
- **The high surface area and porosity of building materials** in the animal house and urban areas may provide a niche for MOB

Methanotrophic bacteria



Source: Dedhys et al, 1998



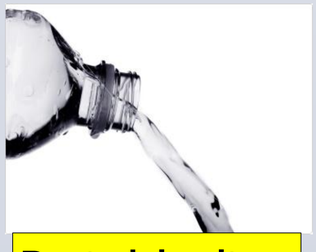
Sources: www. google.com

Research goal:

To investigate the methane removal capabilities of MOB immobilized on porous building materials

Materials and Methods

- Methane removal capabilities of different MOB cultures inoculated in different building materials in a closed incubator under methane/air atmosphere at high (20% (v/v) and low (50 ppmv) methane concentration



Bacterial culture

Building materials

Liquid separation

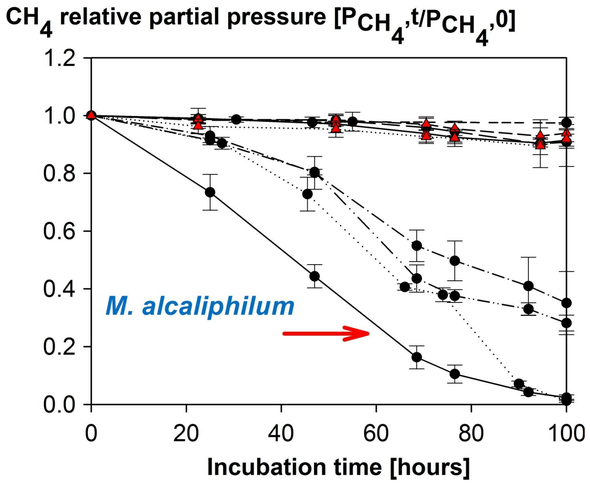
Methane

Bacteria (MOB)
M. alcaliphilum
M. kenyense
M. trichosporium
M. parvus
M. methanica
Mixed culture

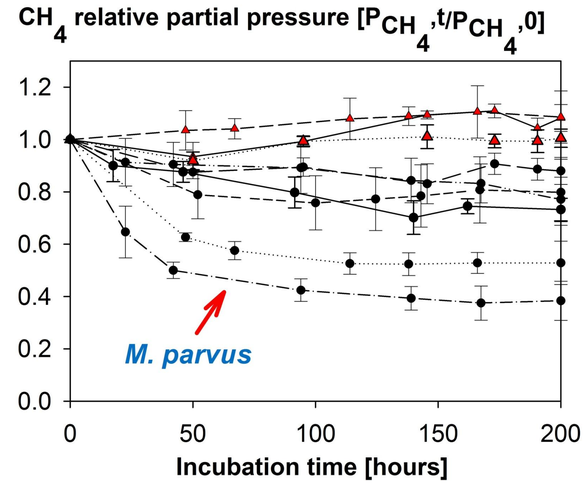
Results

(A) Bacterial methane removal efficiency in building materials

High concentration

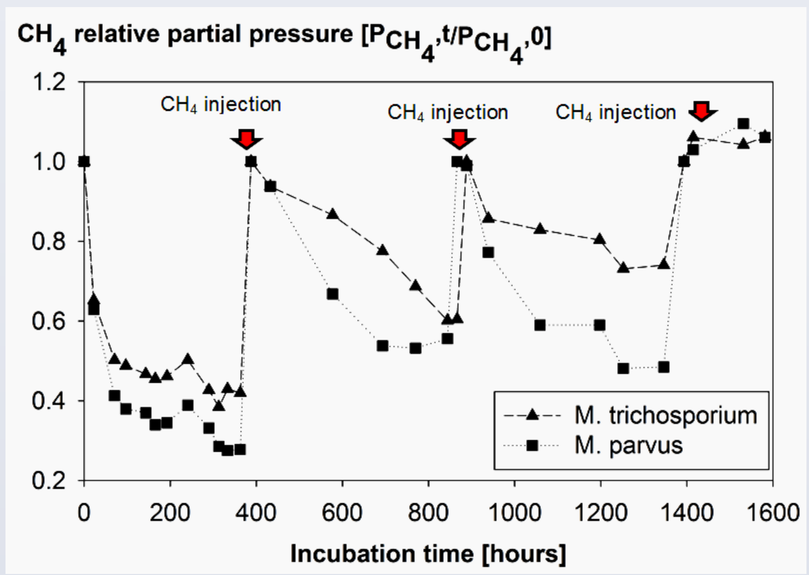


Low concentration



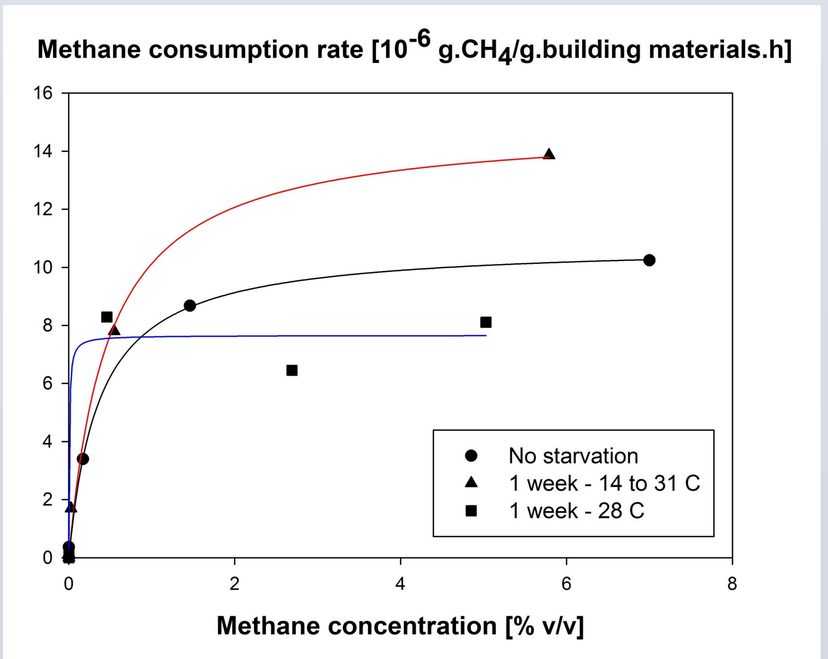
Among all building materials, **Maastricht limestone** (graphs above) provided the best support for the highest methane removal by MOB at high (99.9% removal after 100 hours by ***M. alcaliphilum***) and low concentration (64% removal after 200 hours by ***M. parvus***)

(B) Period of methane removal by MOB inoculated in M. limestone



With pulse feed methane injection process, MOB could still remove methane at low concentration for approximately **2 months**

(C) The influence of methane starvation to methane removal capacity of *M. parvus* in M. limestone



Bacteria **could still remove methane** after 1 week of methane deprivation at varying or constant temperature with altered methane removal kinetics

Conclusion:

MOB can efficiently remove methane when incorporated in building materials with a high robustness and longevity

Acknowledgements

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