BIOTECHNOLOGICAL PROCESSES FOR THE ABATEMENT OF THE GREENHOUSE GAS CH_4: FROM CELLS TO THE BIOREACTOR

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Greenhouse gas (GHG) emissions constitute nowadays one of the most critical environmental problems to deal with, as they are responsible for global warming and climate change. In this context, methane (CH_4) is a gas with a global warming potential 23 times higher than that of CO_2 and represents a significant share among GHG emissions.

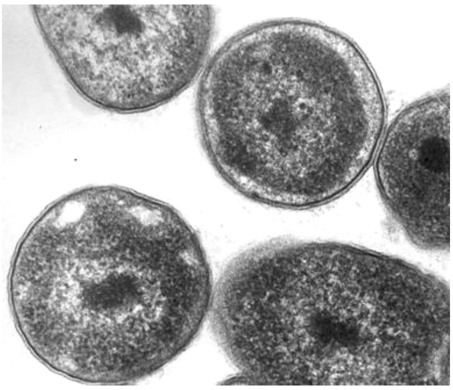

Figure 1. Transmission electron micrograph of a type II methanotroph isolate. (http://genome.jgi-psf.org/metsi/metsi.home.html).

Despite the fact that physical/chemical abatement technologies have been traditionally implemented to reduce CH_4 emissions, biotechnologies have recently emerge as more environmentally friendly techniques with promising abatement efficiencies and lower operating costs compared to their physical/chemical counterparts. Nevertheless, biotechnologies for CH_4 abatement still suffer from several limitations such as the mass transfer limitation, the poor knowledge about the CH_4 biodegradation kinetics, the selection and the characterization of microorganisms with high affinity for the targeted GHG.

The present project aims to overcome the above-mentioned limitations using different approaches, with a special emphasis on the optimization of the process microbiology and the bioreactor design:

A) The development of a **new generation of high-performance bioreactors with enhanced CH_4 mass transfer** such as two-phase partitioning bioreactors (TPPBs), membrane and fungal bioreactors. The benefits from using these novel bioreactors have been recently proven to support higher GHG concentration gradients and/or larger gas/liquid interfacial areas.

B) The study of CH_4 degradation microbiology via **selection and characterization of microbiota with high affinity for CH_4**, including microbial kinetic studies and media optimization for types **I**, **II** or X methanotrophs (**Fig** 1). This research project also aims at optimizing growth conditions inside the bioreactors in order to couple the methane biodegradation with the production of **high added-value products** from these microorganisms.

C) The use of molecular biology techniques such as denaturing gradient gel electrophoresis (**DGGE**), stable isotope probing (**SIP**), polymerase chain reaction (**PCR**), fluorescence in situ hybridation (**FISH**) or even cloning techniques to characterize genes encoding key enzymes involved in CH_4 biodegradation or in the production of high-added value products.

More information available at:

http://etuva.blogspot.com.es/

Relevant publications

López JC, Quijano G, Souza TSO, Estrada JM, Lebrero R, Muñoz R (in press) Biotechnologies for greenhouse gases (CH_4, N_2O, CO_2) abatement: state-of-the-art and challenges. Applied Microbiology and Biotechnology.

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