HIGH CH_4 CONSUMPTION RATES BY *Sphingobacterium* sp.

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Introduction. Methane (CH_4) is the second greenhouse gas after CO_2, with a global warming potential between 25-72. It is produced during enteric fermentation, natural gas extraction, oil refining, wastewater treatment and mines, mainly [1]. When the percentage of CH_4 is below the explosive limit (5% in air) biological treatments are a viable option to degrade it and methanotrophic bacteria have been studied [2,3]. However, CH_4 removal is restricted by its low solubility (28 mg L^{-1}), so the systems are normally limited by mass transfer. The objective was to characterize a new bacterium with high CH_4 consumption rates and to study CH_4 degradation in different bioreactors configurations.

Methods. The strain was isolated from a consortium of methanotrophic bacteria obtained of the wastewater treatment plant in UAM-Iztapalapa [2]. Bacterium was isolated by the streak plate method on mineral salts medium solidified with Gelrite Gellan Gum. Plates were incubated in CH_4 atmosphere at 30°C. Bacteriological agar and CH_4 degradation capacity was tested at different concentrations in closed flask systems. The consumption rates were determined using the Gompertz model.
The strain was previously identified by molecular biology techniques as *Sphingobacterium* sp. DDT-6 with a sequence identity of 97.5%. The isolate was tested in a stirred tank reactor, a two phase partitioning bioreactor and a membrane reactor under the same conditions reported by Zuñiga et al., 2011.

Table 1. CH_4 consumption, CO_2 production rates at different percentages of CH_4 in closed flasks

CH_4 (%)	r_{CH4} (g m^{-3} h^{-1})	r_{CO2} (g m^{-3} h^{-1})	q_{CH4} (mg_{CH4} g_x^{-1} h^{-1})
5	1.64 ± 0.02	0.51 ± 0.07	55 ± 6.1
10	8.06 ± 0.16	0.17 ± 0.01	203 ± 10.5
15	5.16 ± 0.68	0.19 ± 0.02	142 ± 11.1
20	3.99 ± 0.17	0.26 ± 0.01	79. ± 4.9
Control X	nd	0.17 ± 0.02	nd

Results.
Table 1 shows that the maximum specific degradation rate was 203 mg_{CH4} $(g_x\ h)^{-1}$ at 10% CH_4 in closed flask experiments. Figure 1 shows the evolution of the specific CH_4 consumption rate in the stirred tank reactor. Although the highest and initial value was 350 $mg_{CH4}(g_xh)^{-1}$, and in the steady state was around 150 $mg_{CH4}(g_xh)^{-1}$, the first value is higher than the 300 $mg_{CH4}(g_xh)^{-1}$ reached in membrane reactor. Finally in the two phase partitioning bioreactor 80 $mg_{CH4}(g_xh)^{-1}$was achieved

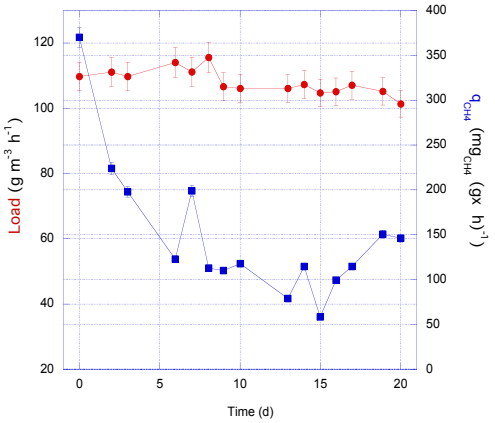

Fig.1 Specific CH_4 consumption rate of *Sphingobacterium* sp. in a stirred tank reactor.

Conclusions. *Sphingobacterium* sp. has CH_4 consumption rates twice higher than values reported for any methanotroph. This is the first report of CH_4 consumption by this bacterium.

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References.

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3. Zúñiga C, Morales M, LeBorgne S, Revah S. (2011) Production of poly-β-hydroxybutyrate (PHB) by *Methylobacterium organophilum* isolated from a methanotrophic consortium in a two-phase partition