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A NEW BIOLOGICAL PROCESS FOR CO_2 VALORIZATION

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Statement of the Problem: CO_2 is one of the major greenhouse gases accumulating in the atmosphere, with anthropogenic emission of about 35 Gt/y. Among processes that are being developed to help reducing CO_2, biological processes are promising as they seem to be more efficient and less energy consuming. Under certain conditions, some microorganisms can use CO2 as a carbon source for fuel production. This work presents a new microbiological process for CO_2 reduction into formate, which is being patented. Compared to other biological process, an intracellular energy source is used for the reaction, meaning that no external energy adding such as H_2, photons or cofactor is required. The biocatalyst is a consortium of two environmental bacteria growing on methane. In this work, labelled $^{13}CO_2$ was implemented to evidence the CO_2 reduction catalyzed by the bacteria. Methodology: The bacterial culture was done on a mineral medium. Once growth phase ended, cells were harvested and resuspended in a phosphate buffer (pH 7,0). Reaction was performed in a 50 mL sealed vial filled with 5 mL of bacterial suspension and a mixture of $^{13}CO_2$:air; independent duplicates were done. The suspension was analyzed by 500-MHz NMR spectroscopy; pH and OD600 were also measured. Findings: Both pH and OD_{600} decreased during the first hours (by about 10% and 30% respectively), then remained constant. All along the reaction, both CO2 and HCO_3^- were visible in the NMR spectrum at δ=124,6 and δ=160,2 ppm respectively, as shown in fig.1; later at t=7 days, a peak with δ=170,9 ppm appeared, which corresponds to formate (fig.1b). Conclusion and perspective: CO_2 reduction into formate is achieved by the bacterial consortium. Quantification of the formate produced and CO_2 consumed will be carried out respectively by ionic and gas chromatography.

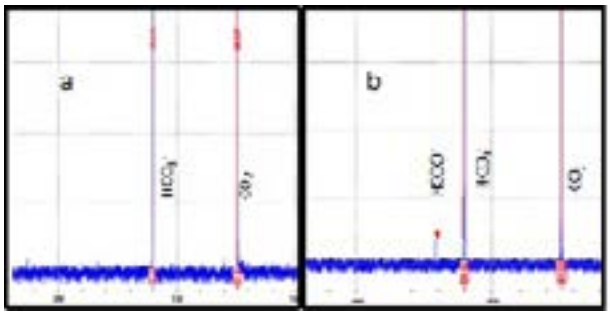

Figure 1: NMR spectrum for CO_2 reduction at the beginning of the reaction (a) and after 7 days (b).

Biography

Azariel Ruiz-Valencia is a PhD student at the European Institute of Membranes. He has been studying by different approaches how microorganisms can help environment, and now his research focuses specifically on the use of microorganisms to convert carbon dioxide into valuable chemicals. He obtained his Master degree at Tuxtla Gutiérrez Institute Technologic.

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