STABLE ISOTOPE TOOLS FOR CHARACTERIZING AND ASSESSING *IN SITU* BIODEGRADATION OF MTBE IN GASOLINE-IMPACTED SITES

Monica Rosell*
Carsten Vogt
Stefanie Finsterbusch
Hans H. Richnow
Department of Isotope Biogeochemistry
Helmholtz Centre for Environmental Research – UFZ
Permoserstrasse 15, D-04318 Leipzig, Germany
Voice: +49 (0) 341 235 1358
Fax: +49 (0) 341 235 1443
monica.rosell@ufz.de

Françoise Fayolle-Guichard
Biotechnology and Biomass Chemistry Department
Institut Français du Pétrole (IFP)
Rueil-Malmaison, France

"In the last decade, compound-specific stable isotope analysis (CSIA) has been employed as a tool for demonstrating in-situ biodegradation of fuel additives such as MTBE or aromatic hydrocarbons in contaminated aquifers. This concept relies on the higher kinetic isotope fractionation during microbial biodegradation among other natural attenuation processes and uses the enrichment of heavy isotopes (13C and 2H) in the residual fraction as an indicator for in-situ biodegradation. Therefore, knowledge of the variability of the MTBE isotope enrichment factors (epsilon) is required to evaluate the uncertainty of quantitative assessment as well as to investigate degradation pathways and reaction mechanisms. In this study, we determined epsilon(C)'s and epsilon(H)'s in laboratory batch experiments from a total of 10 aerobic pure strains in addition to mixed cultures from different gasoline-impacted sites. Lower enrichment factors than previously found were observed for some strains. This fact was not related to their phylogeny or cell wall structure. When possible, the use of two-dimensional isotope analysis allowed the calculation of Lambda factor which is given by plotting the carbon vs. hydrogen isotope discrimination (approx. epsilon(H)/ epsilon(C)). The variations in Lambda values suggest that more than one reaction mechanism exists for MTBE aerobic degradation and this might be linked to the involvement of different monooxygenases in the initial enzymatic attack."

###