

Carbon Stable Isotope Effects as a Tool to Monitor Dechlorination of Trichloroethylene (TCE)

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The strain *Burkholderia Cepacia* G4 aerobically transformed trichloroethylene (TCE) to CO₂ over a time period of ~ 40 hours by using the enzyme toluene mono-oxygenase (TMO). The cells were grown on a 2 mM phenol solution in order to generate this enzyme. The degree of degradation depended on the optical cell density (OD₅₄₀) and was 92.7, 83.8 and 57.2 at OD₅₄₀ values of 2.0, 1.1 and 0.6, respectively. Accordingly, the carbon isotopic differences between initial and final TCE (expressed in per mil $\delta^{13}\text{C}_{\text{VPDB}}$) were 57.2, 39.6 and 17.0 per mil, thus showing the strongest fractionation for the experiment with the greatest extent of TCE removal. The enrichment factor, ϵ , accounts for the Rayleigh fractionation

during any point of the degradation and was determined with -21.07, -20.74, and -18.25 for the three experiments in decreasing order of their OD₅₄₀. Our findings show that carbon isotope fractionations at different enzymatic concentrations can serve as a measure of the extent of TCE removal with *Burkholderia Cepacia* G4. The carbon isotope fractionations systematically differ from other TCE degradation mechanisms, such as dechlorination on zero-valent iron. This indicates that stable carbon isotopic changes may also prove useful to differentiate this aerobic type of degradation from other processes that may take place at the same time in real field applications.