



Laboratory Microcosms with ^{13}C -labeled Contaminants

The complete degradation (mineralization) of an organic compound can be investigated in laboratory microcosms. Groundwater and sediment from the field site are incubated under *in situ* like conditions and a ^{13}C -labeled target contaminant is added. If sediment is not available, we expose our unlabeled BACTRAPs® as an alternative material for the growth of site-specific microorganisms. Based on the ^{13}C accumulation in the end-products ($\delta^{13}\text{C}$ -values of e.g. CO_2 , CH_4 , ethene), complete degradation can sensitively be proven and quantified for a great variety of environmental conditions and pollutants.



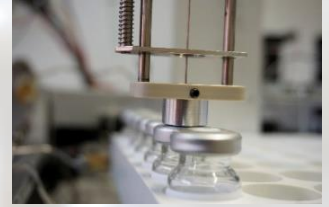
Sampling



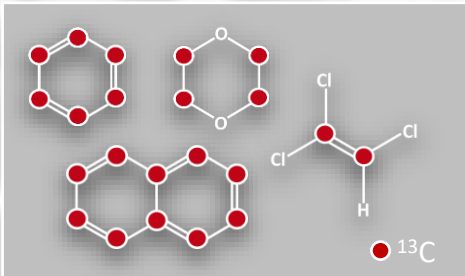
Preparation



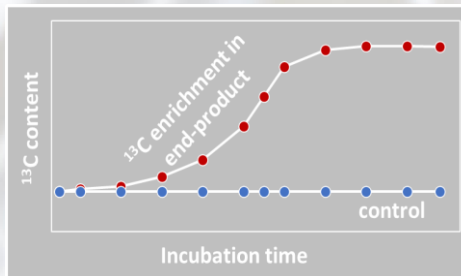
Incubation



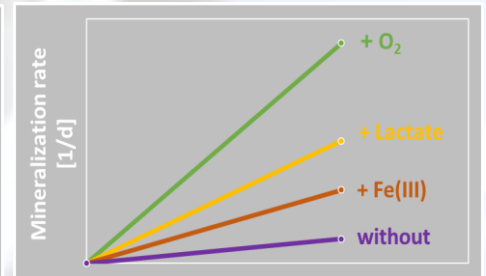
Analysis



Laboratory microcosms are suitable for nearly all organic compounds, which are available with ^{13}C -label, e.g. halogenated and petroleum hydrocarbons, pesticides, BTEX, PAH, pharmaceuticals.



Due to the relationship between conversion of the ^{13}C -labeled contaminant and ^{13}C accumulation in end-products, rates of complete degradation can be determined.



The stimulative and inhibitory effect of certain reagents on biodegradation can be studied. As a result, biostimulation concepts can be evaluated.

Work flow

- In a joint concept, we select target contaminants and spots of the field site to be investigated.
- We provide sampling flasks and protocols to collect sediment and groundwater or perform direct sampling at the field site.
- We prepare the microcosms and determine continuously the $\delta^{13}\text{C}$ -value of end-products.
- The microcosms are incubated for 2 - 12 months depending on redox conditions.
- We determine rates of complete degradation.
- We evaluate stimulative and inhibitory effects of certain reagents.

Outcome

Rates of complete degradation
Proof of stimulative and inhibitory effects

Costs

1.500 - 3.000 € per
microcosm investigation

Processing time

2 - 12 months

Further reading

Morasch B, Höhener P, Hunkeler D. (2007): Evidence for *in situ* degradation of mono- and polyaromatic hydrocarbons in alluvial sediments based on microcosm experiments with C-13-labeled contaminants. *Environ. Pollut.* 148: 739-748.

Bahr A, Fischer A, Vogt C, Bombach P. (2015): Evidence of polycyclic aromatic hydrocarbon biodegradation in a contaminated aquifer by combined application of *in situ* and laboratory microcosms using ^{13}C -labelled target compounds. *Water Res.* 69: 100-109.

Fischer A, Manefield M, Bombach P (2016): Application of stable isotope tools for evaluating natural and stimulated biodegradation of organic pollutants in field studies. *Curr. Opin. Biotechnol.* 41: 99-107.

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