Hypotheses

H1: During degradation of maize and pea litter, n-alkanes are released into the surrounding soil

H2: A gradient of alkanes will arise as a function of the distance to the litter surface, with the highest concentrations close to the emitter

H3: Microbial communities will express genes involved in alkane degradation depending on the bioavailability, which is different at different microsites and for different species

H4: Activity of the expressed protein (AlkB) is independent from the bioavailability of alkanes

Introduction

Soils are complex habitats with an extremely high number of biogeochemical interfaces (BGI) which serve as a reactive surface where organic pollutants (originated from agriculture, industry, traffic, etc.) are metabolized by various soil microorganisms. The rate of pollutant degradation is thereby dependent of the pollutant's chemical structure, the bioavailability as well as the number of microorganisms with respective catabolic activity (Totsche et al. 2010).

One example for substances which are retained in soils and exposed to the BGI's are hydrocarbons like n-alkanes, which are ubiquitous in the environment (e.g. cuticular waxes, seed oils, oil spills) and subsequently a highly abundant carbon and energy source for many litho-autotrophic bacteria. This project analyzes the influence of maize and pea litter-derived alkanes on the alkane monooxygenase gene alkB and the soil bacterial community at different soil-microsites in dependency of soil type and bioavailability of alkanes.

Methodological Approach

Microcosms of two different soils (sand, loam) were incubated in vitro up to 30 weeks with constant temperature and soils moisture. During the incubation plant litter material of maize and pea plants was used as natural alkane source. Different layers of the soil column were sampled with destructive and non-destructive methods. Abundance and Expression of the alkB gene, the cell number of alkane degrading bacteria as well as the bacterial community structure were analyzed. See also detailed poster presentation of methods used.

Abstract of First Achievements

Abundance:

- Influence of soil type (sandy, loamy soil) and soil-layer on the abundance of alkB gene (Fig. a) for maize and pea litter (data for pea litter not shown)
- No influence of soil type or layer on the expression of the alkB gene (Fig. b) for both litter types (data for pea litter not shown)

Diversity:

- Increasing species richness over the time (Fig. c)

Contributions to SPP's Grand Goals

- Evaluation of biotic and abiotic factors shaping microbial community structure and function in the plant litter-soil-interface
- Correlation of bioavailability of alkanes to dynamic of alkane degrading bacteria
- Alkane release from natural sources (plant litter material)
- Resolution in time and space using destructive & non-destructive sampling methods

References


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