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Phytoremediation and mycoremediation

Oral presentations

THE POPLAR ENDOPHYTE *PSEUDOMONAS PUTIDA* W619 AS A KEY TO A SUCCESSFUL PHYTOREMEDIATION OF VOLATILE ORGANIC CONTAMINANTS: FROM THE LAB TO THE FIELD

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Abstract

Phytoremediation of volatile organic contaminants is often unsatisfactory because plants and their rhizosphere do not completely degrade these compounds resulting in evapotranspiration through the leaves causing secondary contamination of the ambient air and by consequence undermining the merits of phytoremediation. Under laboratory conditions, endophytic bacteria equipped with the appropriate degradation pathway can be used to improve the *in planta* degradation of organic contaminants resulting in decreased phytotoxicity and evapotranspiration.

In this work, we describe the different experiments that were performed in order to move endophyte-enhanced phytoremediation from lab-scale experiments towards application on a TCE-contaminated field site. Poplar cuttings were exposed to trichloroethylene (TCE) in 3 different experimental set-ups, more specifically a short-term (days) hydroponics experiment, a midlong-term (weeks) pot experiment, and finally in a long-term (months) field trial. In order to improve the phytoremediation efficiency, poplar cuttings were inoculated with the TCE degrading root endophyte *Pseudomonas putida* W619.

In the short-term hydroponics experiment, *P. putida* W619 colonized all plant parts except the leaves which resulted in a very significant plant growth promoting effect and a slightly diminished (23%) TCE evapotranspiration. In case the cuttings were grown in pots filled with potting soil, a growth promoting trend and a 41% decreased TCE evapotranspiration were observed after the roots and the stem were colonized by *P. putida* W619. In the field experiment, 3 months after inoculation, the inoculated root endophyte *P. putida* W619 could only be re-isolated from the roots. However, also some natural abundant stem endophytes got equipped with the TCE metabolic activity by horizontal gene transfer. Although the inoculation did not significantly affect plant growth, a 90% reduced TCE evapotranspiration was achieved after inoculation.

These results demonstrated that the endophyte *P. putida* W619 could be the key to both, increasing biomass production on marginal, nutrient poor land and also to an optimized phytoremediation of volatile organic contaminants.

Furthermore, we can conclude that although we can learn a lot from lab-experiments, it is often very difficult to extrapolate lab-scale observations to real life field applications. However, the combination of the results obtained from these experiments at different levels of complexity provided us with new, interesting knowledge that can be exploited in future field applications.