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## Phytoremediation of Petroleum-Contaminated Soils in the Tropics

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### Abstract

Phytoremediation is a non-destructive and economic *in situ* technology that uses plants to remove, degrade or stabilise contaminants in soils. In oil-contaminated soils, it is based on the stimulation of microbial degradation in the rhizosphere. Although phytoremediation is especially promising for the tropics due to climatic conditions that favour plant growth and microbial activity, research was so far mostly limited to the temperate zone. Furthermore, factors controlling the process and success of phytoremediation are still not well understood. The presented project was a co-operation of the University of Hohenheim and PDVSA-Intevop (Centro de Investigación y Apoyo Tecnológico de Petróleos de Venezuela S.A.). The studies were carried out with plants and soil from the savannah of eastern Venezuela. Results are expected to assist in the development and application of phytoremediation not only in Venezuela but also in other tropical countries. After the pre-selection of plants collected on crude oil contaminated sites, species with characteristics promising for phytoremediation were screened in a greenhouse experiment for their ability to increase the degradation of petroleum hydrocarbons in soil. Soils planted with the pasture grass *Brachiaria brizantha* showed a significantly lower oil concentration after 180 days than unplanted soil. In subsequent expanded experiments with *B. brizantha*, fertiliser levels were adjusted to obtain best plant growth and highest oil dissipation. Microbiological studies of rhizosphere and non-rhizosphere soil showed that *B. brizantha* had a prevalently increasing effect on microbial numbers, especially on fungi. Since they tolerate lower pH values than bacteria, they are considered to play a central role in oil degradation, especially in acid savannah soils. Analysis of carbon source utilisation patterns showed different microbial community structures in rhizosphere vs. non-rhizosphere soils. In particular, D,L- $\alpha$ -glycerol phosphate was more used in the rhizosphere, pointing to a higher availability of phosphorus, which is essential during oil degradation but scarce in savannah soils. Although greenhouse experiments help to clarify some important issues of phytoremediation factors and mechanisms, field trials are considered indispensable for the investigation of phytoremediation. Future research issues should include fertiliser composition and the particular role of fungi in phytoremediation of acid savannah soils.

**Keywords:** *Brachiaria brizantha*, oil contamination, petroleum hydrocarbons, phytoremediation, rhizosphere