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Rhodococcus bacteria can help clean up fuel-contaminated sites

Fuel spillages and leaks from petroleum storage facilities can lead to serious pollution of soils and underground water. In a recent study, two strains of *Rhodococcus* bacteria were found to be effective at degrading a number of petroleum hydrocarbons and thus helping clean up contaminated sites.

Fuels can be significant pollutants of soils and groundwater, especially around fuel storage facilities where spills and leaks from faulty pipelines and underground storage tanks can lead to contamination by a mixture of petroleum compounds.

These pollutants have different solubilities in water and different rates of breakdown in the environment. Furthermore, the different compounds found in diesel oil, petrol (gasoline) and fuel additives can interact with each other to create new effects. For instance, the solubility of some compounds can be enhanced, or the mobility of others can be increased.

In this study, the researchers investigated the capacities of *Rhodococcus* bacteria to break down a wide range of petroleum hydrocarbons and fuel additives, such as MTBE (methyl *tert*-butyl ether) and ETBE (ethyl *tert*-butyl ether). These additives, used to raise the octane number, have a large contamination potential.

A mixture of bacteria was cultured from samples taken from different environments, including soil from a petrol station polluted by leaking tanks. From this mixture of bacteria, two strains of *Rhodococcus* bacteria*, Rhodococcus wratislaviensis* and *Rhodococcus aetherivorans,* were isolated and tested for their capacity, individually or together, to biodegrade a mixture of 16 hydrocarbons and additives. The selection and the study of certain bacteria is of great interest because it could facilitate the study of the effects of selective pressure in terms of gene acquisition.

R. wratislaviensis showed remarkable potential and was able to completely break down 11 of the 16 compounds tested, including o-xylene, cyclohexane and cyclohexanol, and partially degrade four others, but sometimes needed another solvent to achieve this.

R. aetherivorans was less effective in degrading the tested petroleum products. However, it was able to significantly break down MTBE and ETBE. When both strains were used together, they completely degraded 13 of the 16 compounds, and partially degraded two others: only tert-butyl alcohol (TBA, a break down product of MTBE) was not degraded.

The interaction between the different petroleum compounds and additives on the action of both bacterial strains was characterised. For instance, *R. wratislaviensis* degraded 72 per cent of MTBE in the presence of octane compared with 15 per cent without octane. While the presence of MTBE did not have an impact on the degradation of ETBE, no MTBE was degraded in the presence of ETBE.

For bioremediation technologies for polluted sites, the authors emphasise the advantage of working with pure strains rather than undefined enrichment cultures and the possible positive role of co-metabolism, which could help overcome inhibitory effects of some compounds on the degradation of other compounds.

Source: Auffret, M., Labbé, D., Thouand, G. *et al.* (2009). Degradation of a Mixture of Hydrocarbons, Gasoline and Diesel Oil Additives by *Rhodococcus wratislaviensis* and *Rhodococcus aetherivorans. Applied and Environmental Microbiology.* 75(24): 7774-7782.

Contact: francoise.fayolle@ifp.fr

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