Microbial Dehydration of 2-Methylisoborneol in Forest Soil

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Abstract

Microorganisms use a complex array of chemical compounds to interact with their surroundings. They produce and process different molecules in response to changes in the environment or in their metabolism. One of the most well known volatile organic compounds produced by microorganisms is the C11-terpenoid 2-methylisoborneol (2-MIB), which has received attention because of the off-flavor it confers to fresh and reservoir water as well as to cultured fish. Cleaning water supplies of the off-flavor 2-MIB has been of interest for the scientific community for years, with the use of techniques that are either expensive e.g. activated carbon, or create toxic byproducts e.g. ozonation. In the present study, soil samples from nature were collected from a forest and the volatile organic compounds produced by microbes were extracted and analyzed with focus on non-canonical terpenoid structures. HS-SPME-GC/MS analysis of soil samples revealed 1-methylcamphene, 2-methylenebornane and 2-methylisoborneol as C11-terpenoids. Due to the high 1-MC/2-MIB ratio compared to previous reports, it was hypothesized that microbial degradation of 2-MIB was in place. Addition of synthetic 2-MIB to biologically active soil revealed complete dehydration of the pollutant to 2-MB, 1-MC and 2-methyl-2-bornene (2-M2B). The results suggest the potential of using respective natural microorganisms for biodegradation of 2-MIB, with applications in water treatment, fishery and soil ecology.

Full Text

This preprint is available for download as a PDF.

Figures

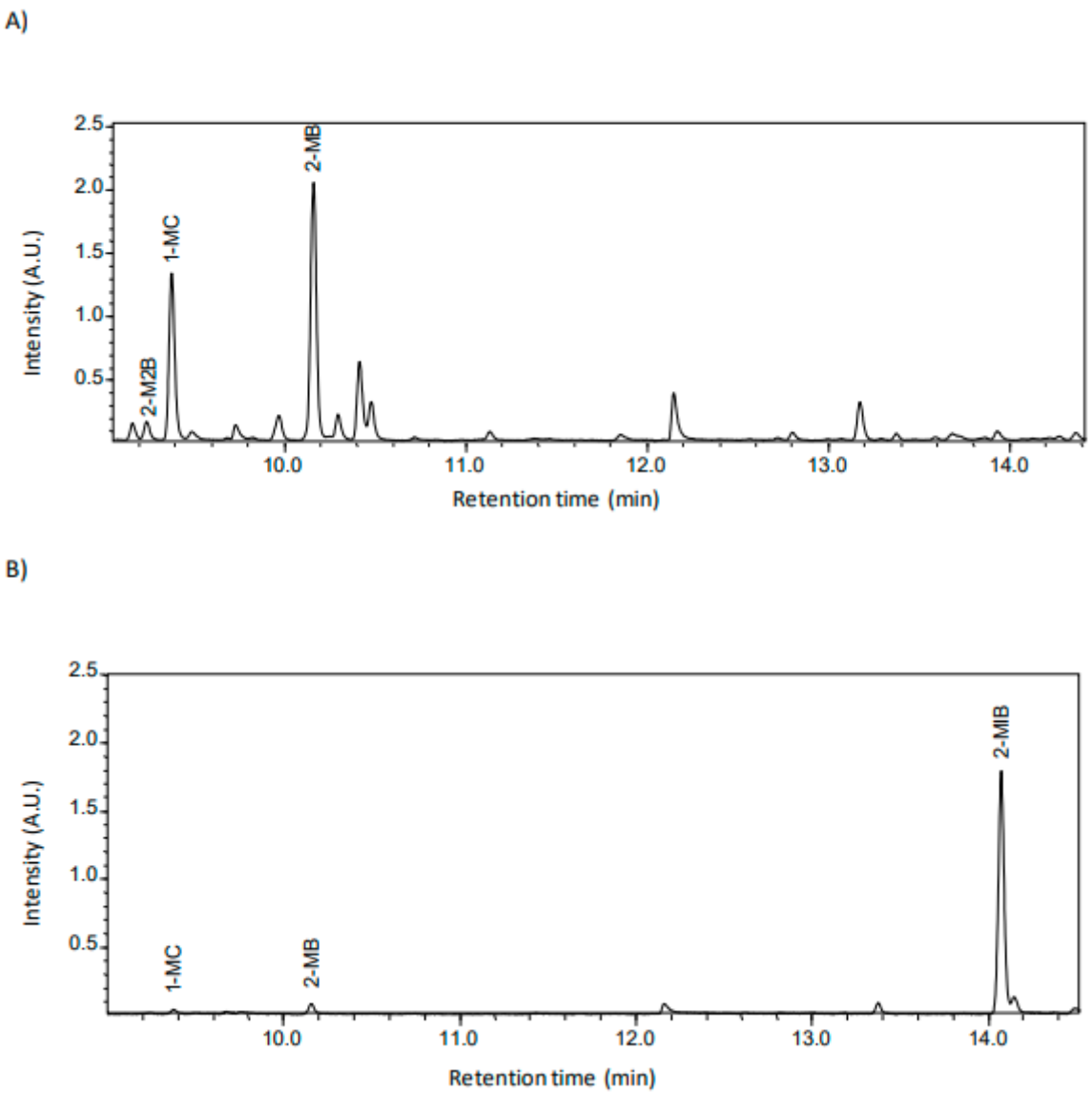

Figure 1

Headspace-SPME-GC-MS analysis of natural soil sample (A) and sterile soil sample (B) after addition of 2.5 µg of 2-MIB.