Pollutant biodegradation: mountain or Mohammed?

There is currently considerable interest in factors affecting the rates of microbial biodegradation of hydrocarbon pollutants in soils and aquifers. It is generally recognized that heterotrophic activity in aquatic and soil environments is concentrated in biofilms, and that adsorption/desorption of organic pollutants between aqueous and particulate phases play important roles in the process. In some cases, the addition of sediments accelerates biodegradation (4) whereas in others there is retardation (3, 5). Thus these effects are probably organism- and/or pollutant-specific. On the other hand, there is growing consensus that the addition of surfactants (synthetic or natural) to aqueous sediment or soil systems enhances the rate of biodegradation of hydrocarbons (1, 2, 7). Such enhancement is invariably attributed to solubilization of the substrate thus allowing bacteria access to the substrate in the liquid phase. No doubt this is an important contribution, but a further possibility which appears to have been ignored is that the added surfactant may be to bring the bacterial surface-associated microorganisms, but would also account for the reported situation where added surfactant stimulates attachment of bacteria to sediment particles, thereby bringing substrates and competent organisms together but at the solid-liquid interface. This scenario would not be consistent with observations that most of the heterotrophic activity in rivers arises from surface-associated microbial populations, but would also account for the reported situation where added surfactant stimulates biodegradation but not desorption of the substrate (2). In Cardiff, we have observed that addition of biodegradable surfactants stimulates bacterial attachment to sediments (6), and that simultaneously the presence of sediment accelerates biodegradation of surfactant (J. R. Marchesi, N. J. Russell & G. F. White, unpublished results). Thus the role of the surfactant may be to bring the bacterial mountain to a substrate Mohammed, as well as vice versa.

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