Biotech Methods for Intelligent Site Management

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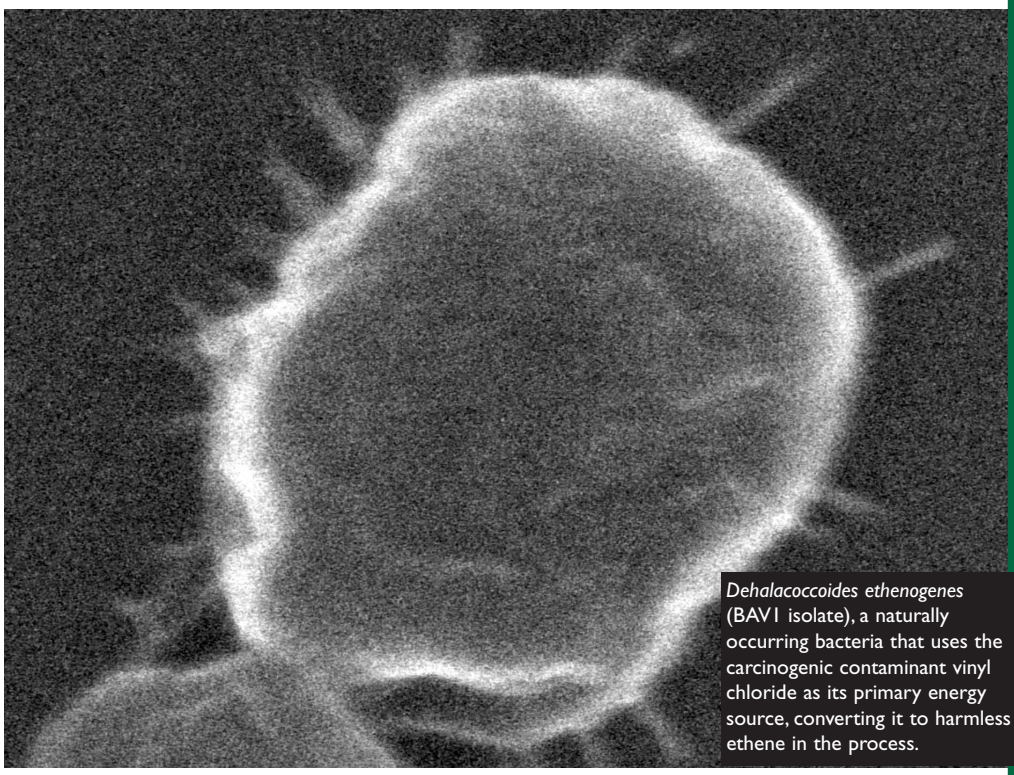

Dehalacoccoides ethenogenes (BAV1 isolate), a naturally occurring bacteria that uses the carcinogenic contaminant vinyl chloride as its primary energy source, converting it to harmless ethene in the process.

It has long been recognized that microorganisms play an important role in the decontamination of environmental pollutants because certain naturally occurring microbes have an astounding ability to convert dangerous toxins into harmless compounds. This in situ approach to the bioremediation of environmental contaminants, a formerly marginalized approach to site cleanup, has experienced a biotech renaissance. Speakers at this year's Environmental Biotechnology Platform Session described some of the many ways that genomics, cellular characterization and other biotech methods have helped to bring the so-called "third line of evidence" to the fore.

"Today we have the opportunity to do things we couldn't do previously," says Stephen Koenigsberg of Regenesis Bioremediation Products. Over the past twenty years, advances in molecular biology have provided environmental scientists with a whole new set of wonderful tools, he says. "With these new tools we're now in a position to answer questions about the third line of evidence, the microbial ecology. We want to ask the microbes who they are, where they are and what contaminants they eat. Software traditionally used to depict the location of contaminants in an aquifer can also be input with data on microorganism concentrations derived from biotech-based analytical methods in order to visualize the microbial ecosystem of a contaminated site. That's bug mapping," Koenigsberg explains.

Until recently, the biotech methods developed during the 1980s and '90s were not user friendly and largely unavailable for use in the environmental cleanup industry. Today there is a wide variety of sampling and analytical tools that make it relatively easy, fast and cost-effective to monitor the bioremediation activity of microorganisms.

"Genomic technologies are leading to explosive advances in this area," says Eric Hince of Geovation Consultants. "They're now coming into an age where they're acceptable for costs that are reasonable," Hince notes. "It's just a matter of getting people to understand these tools and to start using them more consistently. Then we'll start making some real leaps forward."

Already, leaps have been made. Using biotech methods, Koenigsberg and his colleagues at Georgia Tech isolated a naturally occurring bacteria that uses the carcinogenic contaminant vinyl chloride as its primary energy source, converting it to harmless ethene in the process. News of their discovery was published in a 2003 issue of the journal *Nature*. Highly specific genetic tests designed to identify the presence and expansion of these key organisms in relation to engineered bioremediation have also been developed and published in *Applied and Environmental Biotechnology*.

However, not all bacteria can sustain themselves on toxic substances alone. Some require "food" in the form of oxygen or hydrogen substrates. "The objective is to assess the microbial ecology, augment it if necessary, and then maintain it with substrate applications (oxygen or hydrogen depending on whether the bacteria are aerobic or anaerobic). It's about better monitoring to ensure effective remediation of the site. That's intelligent site management," Koenigsberg said.

"Get to know your microbes. They are the ones doing the heavy lifting," Koenigsberg insists. "So, get to know them intimately. It's more information and information is power – *scientia est potentia.*"

By Loren Walker www.L2W.cc