

**Identification and Characterization of Xenobiotic-Degrading
Microorganisms for Application to the Field of Bioremediation.**

by

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ABSTRACT

The field of bioremediation involves a variety of multifaceted techniques, many of which are not fully understood and thus not optimized in practice. This is especially true in the case of recalcitrant and difficult to degrade compounds like polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). The research presented here was done with the aim of elucidating the contributions that three novel bacterial strains can make to the bioremediation of these two classes of compounds. The first novel strain, *Sphingopyxis* sp. strain M2R2, is a PAH-degrading, aerobic soil bacterium. Its capabilities include phenanthrene and naphthalene metabolism and passive spreading motility through agar media as well as soil. The second novel strain, *Mycobacterium* sp. strain U1A, is an endophytic (residing within plant tissues) bacterium capable of metabolizing phenanthrene and pyrene. It is also capable of benzo[a]pyrene co-metabolism. Tests have shown that it can protect host plants from the effects of phenanthrene phytotoxicity. The third and last project utilized an enrichment culture, consisting solely of members of the genus "*Dehalococcoides*," which is capable of metabolically dechlorinating a range of PCB congeners. A protocol was developed with the aim of purifying and identifying a PCB-dechlorinating reductive dehalogenase enzyme (RDase) from this culture. Successful solubilization and separation of the membrane-associated RDase was achieved through the use of blue native polyacrylamide gel electrophoresis. Further work with this protocol may result in the identification of the first RDase with PCB-dechlorinating capabilities and a major breakthrough toward a viable method of PCB bioremediation.

Each of these three projects represents a significant contribution to the body of knowledge supporting the practice of bioremediation, a promising field that is in need of research to optimize the technology.