

## ELECTRON DONOR PREFERENCE OF A REDUCTIVE DECHLORINATING CONSORTIUM

Michelle M. Lorah, Emily Majcher (U.S. Geological Survey, Baltimore, MD, USA), Elizabeth Jones (U.S. Geological Survey, Reston, VA, USA), Greg Driedger, *Sandra Dworatzek* (SiREM Laboratory, Guelph, Ontario, Canada,) and Duane Graves (GeoSyntec Consultants, Knoxville, TN, USA)

A wetland sediment-derived microbial consortium (WBC-2) was developed by the U.S. Geological Survey and propagated *in vitro* to large quantities by SiREM Laboratory for use in bioaugmentation applications. The consortium has the capacity to completely dechlorinate 1,1,2,2-tetrachloroethene (TeCA), tetrachloroethene, trichloroethene, 1,1,2-trichloroethane (TCA), *cis*- and *trans*-1,2-dichloroethene (DCE), 1,1-dichloroethene, 1,2-dichloroethane, vinyl chloride, carbon tetrachloride, and chloroform. Prior to field application in a bioaugmentation pilot test, the WBC-2 consortium was incubated in the laboratory under anaerobic conditions in the presence of several different soluble and insoluble electron donors. This presentation discusses results of bench-scale tests to identify electron donors that support and enhance rates of complete dechlorination.

A suite of electron donors with characteristics useful for bioaugmentation applications was tested. The electron donors included lactate (the donor used during WBC-2 development), ethanol, chitin (Chitorem™), hydrogen releasing compound (HRC™), emulsified vegetable oil (Newman Zone™), and hydrogen gas. Each electron donor was added to microcosm reactors in stoichiometric excess relative to the available chlorinated compounds. Relative performance of each electron donor was evaluated based on the dechlorination of parent compounds (TeCA, 1,1,2-TCA, and *cis*-1,2-DCE), the production and subsequent dechlorination of degradation products, and the formation of ethene. Test results demonstrated that ethanol, lactate, and chitin were particularly effective with respect to stimulating, supporting, and sustaining reductive dechlorination of the broad suite of chemicals WBC-2 has been shown to biodegrade.

Chitorem™ was the most effective “slow release” electron donor tested. It is a complex electron donor that contains chitin (low solubility) as well as other organic materials associated with the organisms from which the chitin is recovered (high solubility). Tests were performed to evaluate whether chitin and other low-solubility chemicals support the observed dechlorination or whether water soluble materials present in Chitorem™ stimulates dechlorination. Chitorem™ was washed with multiple rinses of deionized water followed by recovery of insoluble particles. Washed and unwashed Chitorem™ was added to WBC-2 in batch tests. These treatments supported comparable levels of dechlorination, indicating that readily water-soluble components are not essential to support reductive dechlorination.

Dechlorination rates of TeCA, 1,1,2-TCA, and *cis*-1,2-DCE by WBC-2 were most rapid with the addition of ethanol, lactate, and chitin in the suite of electron donors tested. These materials provide both soluble and insoluble electron donor options for bioaugmentation applications.

Michelle M. Lorah  
US Geological Survey  
8987 Yellow Brick Rd  
Baltimore, MD 21237  
[mmlorah@usgs.gov](mailto:mmlorah@usgs.gov)  
410-238-4200

Emily Majcher  
US Geological Survey  
8987 Yellow Brick Rd  
Baltimore, MD 21237  
[ehmajche@usgs.gov](mailto:ehmajche@usgs.gov)  
410-238-4200

Elizabeth Jones  
430 National Center  
12201 Sunrise Valley Drive  
Reston, VA 20192  
[ejjones@usgs.gov](mailto:ejjones@usgs.gov)  
703-648-5894

Greg Driedger  
SiREM Laboratory  
130 Research Lane, Suite 2  
Guelph, Ontario N1G 5G3  
Canada  
[gdriedger@geosyntec.com](mailto:gdriedger@geosyntec.com)  
519-822-2230 (phone)  
519-822-3151 (fax)

Sandra Dworatzek  
SiREM Laboratory  
130 Research Lane, Suite 2  
Guelph, Ontario N1G 5G3  
Canada  
[sdworatzek@geosyntec.com](mailto:sdworatzek@geosyntec.com)  
519-822-2230 (phone)  
519-822-3151 (fax)

Duane Graves  
GeoSyntec Consultants  
1531 Dick Lonas Road, Building A  
Knoxville, TN 37909  
[dgraves@geosyntec.com](mailto:dgraves@geosyntec.com)  
865-330-0037 (phone)  
865-330-9949 (fax)