FLORIDA STATE UNIVERSITY

Grant Information: Institution, Principal Investigator(s), Contact Information, Grant Number	**Florida State University** **Project:** Enhancing Bioremediation of Groundwater Co-Contaminated by Chlorinated Volatile Organic Compounds and 1,4-Dioxane Using Novel Macrocyclic Materials **Project Leaders**: Youneng Tang, Yuexiao Shen (Texas Tech University) **Funding Period:** 2021-2025
Technology	First, a macrocyclic material selectively adsorbs chlorinated volatile organic compounds (CVOCs) and promotes dechlorinating biofilm on the material surface to anaerobically biodegrade CVOCs. After the CVOCs treatment, another macrocyclic material efficiently adsorbs 1,4-dioxane and sustains biofilm to aerobically metabolize 1,4-dioxane.
Innovation	**Materials:** Macrocyclic materials that selectively adsorb either CVOCs or 1,4-dioxane. **Biological:** 1,4-dioxane-degrading cultures that can metabolize 1,4-dioxane at environmentally relevant concentrations. **Why is this technology/approach different than what is already in the market?** The selective sorption enables separation of CVOCs from 1,4-dioxane, which further enables their biodegradation that requires different environmental conditions. The high efficiency of the 1,4-dioxane, which further enables their biodegradation that requires different environmental conditions. The high efficiency of the 1,4-dioxane-degrading cultures enables their application at environmentally relevant conditions.
Contaminant and Media	**Contaminants:** CVOCs and 1,4-dioxane **Media:** Groundwater
Expansion Potential	**Looking Forward: What other contaminants/media would work for your technology?** This remediation framework would also work for other mixed contaminants that require separation before biodegradation. However, the sorbents and microbial cultures should correspondingly change. **Combined Remedy: Would this technology work well with other treatment approaches?** We are evaluating the combination of advanced oxidation process (AOP) with sorption to chemically degrade CVOCs and 1,4-dioxane together.
Sites/Samples	Sites to be determined by Geosyntec Consultants Inc.

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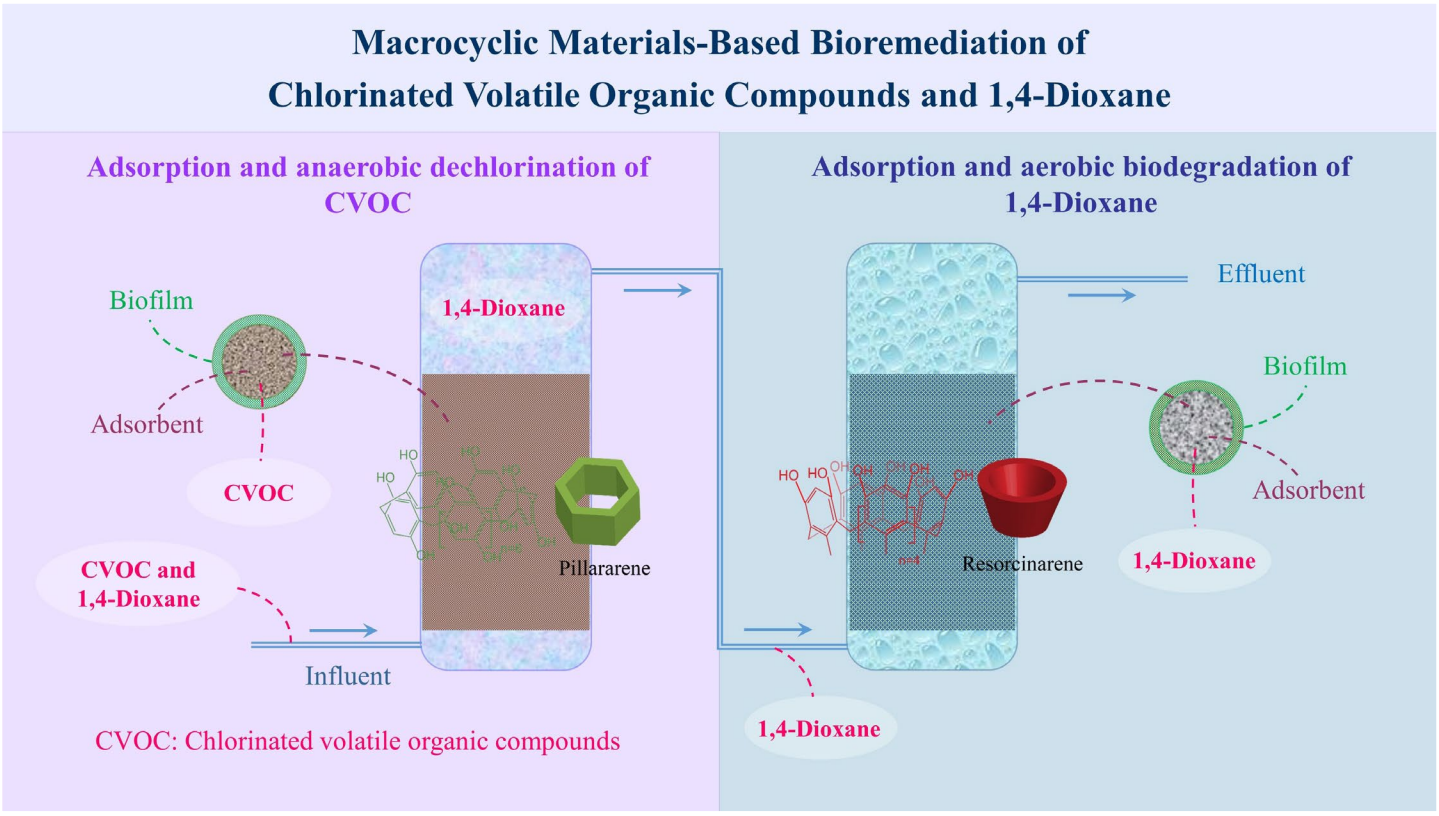
Technology Readiness Level	TRL 4 — Technology validated in laboratory
Update of Progress	Based on atomistic modeling of macrocyclic sorbents and experimental screening of these sorbents, three sorbents that can selectively adsorb CVOCs have been found and synthesized. Five 1,4-dioxane-metabolizing pure cultures that could degrade 1,4-dioxane at low concentrations have been isolated and characterized in terms of taxonomy and biodegradation kinetics. The partial 16S rRNA gene sequences of the five pure strains are deposited at the National Center for Biotechnology Information (NCBI) GenBank database under accession numbers OP362562, OP362563, OP362564, OP362565, and OP362566, respectively. To study the interactions of the sorbents, microbial cultures, and contaminants, a mathematical model has been developed to simulate the simultaneous sorption and biodegradation of 1,4-dioxane. The model has been validated through experiments in continuously stirred tank reactors and data reported in the literature.



Macrocyclic materials-based bioremediation of chlorinated volatile organic compounds and 1,4-dioxane.