Quarterly Report January 20, 2017

MUS Research Initiative Project 51060-MUSRI2015-01: Remediation Technology for Chlorinated Pollutants Based on Natural Product from Soil Bacteria

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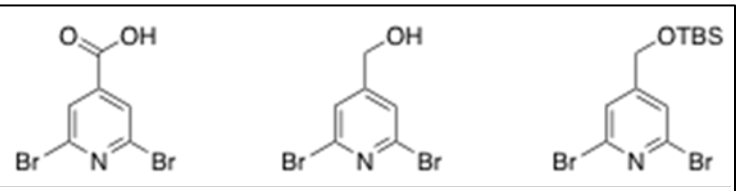
This project's objectives address the programmatic goal of growing important research sectors that increase the diversity of Montana's economy and lies within the 'Materials' category. The work is aimed at deriving improved materials for chlorinated pollutant remediation and is based on an effective process for carbon tetrachloride (CT) destruction in contaminated water. Progress toward specific goals to date are given below.

Objective 1: Have verified, chemically pure PDTC sulfonate, polymer-linked PDTC, and their copper complexes: December 10, 2017

- **Progress Towards Objective:** The experimental procedure for producing pure PDTC from 2, 6 – dibromopyridine has been optimized. The experimental procedure for producing 2, 6 – Dibromocitrazinc acid (Figure 1a) and (2,6 – dibromopyridin-4-yl)methanol (Figure 1b), both PDTC-derivative precursor ligands, has also been optimized. Currently optimizing the protection of the (2,6 – dibromopyridin-4-yl)methanol as in Figure 1c for the dilithiation and direct addition to carbonyl sulfide using the now optimized procedure for production of PDTC.



1a. 1b. 1c.

Figure 1. PDTC-derivative precursor ligands (1a,b), and the bis-dithiocarboxylic acid analog made using carbon disulfide (1c).

Objective 2: Have data regarding solubility and dechlorination rates for new derivatives of PDTC: April 1, 2017

- **Progress Towards Objective:** We have obtained new Cu:PDTC solubility data and found a reliable solubility limit to be ~40 mM in water of 1M ionic strength at 20°C. With this solubility limit we have revaluated our kinetics assay conditions and arrived at a newly determined rate constant of ~17 $M^{-1}s^{1}$. This value will be further refined and used to compare rate constants associated with derivatives.

Objective 3: Have initial toxicology assessment of simulated remediation mixtures, refined dechlorination data to include other solvents, effects of aquifer solids: July 1, 2017

- **Progress Towards Objective:** work on this objective will await deliverables of Objective 1.

Expenditures to Date

Category	Budget Total	As of 09/30/2016
Salaries	148,405	62,220.45
Equipment	35,000	34,822.61
Supplies (MSUB)	10,514	8,566.96
Subcontracts (MSU)	71,940	35,540.45
Travel, other	1,600	3,120.71