Design and Synthesis of Proligand Pyridine-2,6 Dithiocarboxylic Acid and Structural Derivatives for Use in Environmental Remediation of Carbon Tetrachloride

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Carbon Tetrachloride is a carcinogenic pollutant that has contaminated groundwater beneath former grain storage and industrial sites, such as the Department of Energy's Hanford site. Current remediation of these sites involve removal and subsequent treatment, which requires handling of the hazardous material as it is transferred to another location for final destruction. Professor Thomas Lewis has previously described the use of a small molecule (pyridine-2,6-dithiocarboxylic acid [PDTC]), that when complexed with copper has been shown to lead to complete dechlorination of pollutant carbon tetrachloride within atmospheric samples. The process results in conversion to non-toxic end-products (mostly

CO2) and complete removal of the problematic carbon-chlorine bonds. Synthetic chemistry can be employed to develop a series of PDTC derivatives that could increase water solubility and allow for on-site destruction of carbon tetrachloride. The current methods described in literature for the synthesis of proligand PDTC uses or produces large quantities of toxic hydrogen sulfide gas. A modified procedure for large-scale production of PDTC, with minimal hydrogen sulfide production, was successfully developed. However, this method will not be able to be utilized for synthesizing derivatives of PDTC, which defines the need for a novel approach to the development of proligand derivatives. An elegant approach using a dilithiated addition into carbonyl sulfide is currently under investigation to produce PDTC and several derivatives that could be functionalized for use in environmental remediation of carbon tetrachloride.