Evaluating the Effects of Heavy Metals on the Germination and Development of Seeds and Employing the Bioremediation Properties of Wood Mulch in Extracting Heavy Metals from Tar Creek

Carter, Peyton (School: Cascia Hall Preparatory School)

The Tar Creek superfund site is an abandoned lead mine in northeastern Oklahoma that was declared in 1983 and is located in the cities of Picher and Cardin. From 1900 to the 1960's, lead mining and zinc mining companies left piles of "chat"- a gravel-like byproduct of mining that is filled with heavy metals- out in the open fields. After years of remediation efforts, Tar Creek remains an expensive and environmentally detrimental superfund that leaks heavy metals into the state water table. One method of heavy metal removal, bioremediation, utilizes biomasses that are high in carboxylic groups and fibrous structures like lignin and cellulose to absorb heavy metals from water. Wood mulch fits these criteria; mulch is also available cost free due to its high availability and limited uses. Mulch was placed in solutions containing lead, zinc, iron, and cadmium, which are the most prevalent contaminants in Tar Creek. Initial heavy metal concentration were measured and compared to identify trends in changes in concentration after remediation with mulch. Additionally, water samples from 6 sites along Tar Creek were evaluated for turbidity, DO, pH, lead, zinc, iron, and cadmium levels. The site samples were then evaluated for toxicity using the EPA standard lettuce seed bioassay. Sources of error could include timing-related factors, and that some water sample tests were over scale and had to be diluted. All DO tests were conducted on site. The data supports the potential for effective bioremediation of heavy metals using wood mulch, and the potential for wood mulch to buffer pH. Metal retention abilities of mulch and additional remedial properties of mulch are still under evaluation.

Awards Won: