

EVALUATING AN ENZYME BIOASSAY FOR THE PURPOSE OF SCREENING FOR METALS CONTAMINATION IN MINING IMPACTED SOILS (MIS)¹

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Abstract: Mine tailings piles and abandoned mine soils are often contaminated by a suite of toxic metals which were wasted in the mining process. Traditionally, toxicity of such areas has been determined by either a Toxicity Characteristic Leachate Procedure (TCLP) or traditional toxicity tests using organisms such as the cladoceran *Ceriodaphnia dubia*. The TCLP is essentially a total acid digestion, which measures total metals present, *C. dubia* tests take 48 hours, have only 20 organisms per test concentration, and require culturing of organisms. Such tests can also be expensive and time-consuming. Enzymatic bioassays provide an easier, less costly, and more time-effective toxicity screening procedure for mine tailings and abandoned mine soil leachates.

This study evaluated the commercially available enzymatic toxicity assay, MetPLATE™. The MetPLATE™ assay uses a modified strain of the *Escherichia coli* bacteria as the test organism. When the *E. coli* bacteria are not stressed, they produce the enzyme β -galactosidase, which cleaves a chromogenic substrate. Conversely, when the *E. coli* bacteria are stressed, they produce less enzyme, which decreases the amount of substrate cleaved. The inhibition of the enzyme can be measured colorometrically with a 96-well spectrophotometer. The MetPLATE™ assay shows actual toxicity by taking into account the bioavailability of metals in solution, it requires a very short testing period (~2 hours), contains 100,000+ organisms per sample concentration, and eliminates the need for an organism culture. Similar effects to water chemistry variations (hardness, alkalinity, and dissolved organic carbon) are seen with the MetPLATE™ assay *E. coli* as those seen with the traditional toxicity test organism (*C. Dubia*). In water conditions found in mining impacted systems in the Western United States, increased hardness and DOC provide protective effects to the *E. coli* in the MetPLATE™ Test kit.

Additional Key Words: MetPLATE™, metal contamination, mine waste, contaminated soils, toxicity testing

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