

A rapid inhibitive enzyme assay for monitoring heavy metals pollution in the Juru industrial estate

ABSTRACT

The volume of contaminated rivers in Malaysia continues to keep rising through the years. The cost of instrumental monitoring is uneconomical and prohibits schedule monitoring of contaminants particularly heavy metals. In this work, a rapid enzyme assay utilizing the molybdenum-reducing enzyme as an inhibitive assay, prepared in crude form from the molybdenum-reducing bacterium *Serratia* sp. strain DRY5 has been developed for monitoring the heavy metals mercury, silver, copper and chromium in contaminated waters in the Juru Industrial Estate. The crude enzyme extract transformed soluble molybdenum (phosphomolybdate) into a deep blue solution, which is inhibited by heavy metals such as mercury, silver, copper and chromium. The IC₅₀ and Limits of Detection (LOD) values for mercury, copper, silver and cadmium were 0.245, 0.298, 0.367, 0.326, and 0.124, 0.086, 0.088 and 0.094 mg L⁻¹, respectively. The assay is rapid, and can be carried out in less than 10 minutes. In addition, the assay can be carried out at ambient temperature. The IC₅₀ values for these heavy metals are more sensitive than several established assays. Water samples from various locations in the month of November from the Juru Industrial Estate (Penang) were tested for the presence of heavy metals using the developed assay. Enzyme activity was nearly inhibited for water samples from several locations. The presence of heavy metals was confirmed instrumentally using Atomic Emission Spectrometry and a Flow Injection Mercury System. The assay is rapid and simple and can be used as a first screening method for large scale monitoring of heavy metals.

Keyword: Inhibitive assay; Biomonitoring; Molybdenum-reducing enzyme; Heavy metals; Juru industrial estate