

Evaluating Cyanide Biodegradation by Bacteria Isolated from Gold Mine Effluents in Bulawayo, Zimbabwe

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Abstract : The release of cyanide-rich effluents from gold mines, and other industries, into the environment, is a global concern considering the well-known metabolic effects of cyanide in all forms of life. Such effluents need to be treated to remove cyanide, among other pollutants, before their disposal. This study aimed at investigating the possible use of bacteria in the biological removal of cyanide from cyanide-rich effluents. Firstly, cyanide-degrading bacteria were isolated from gold mine effluents and characterised. The isolates were then tested for their ability to grow in the presence of cyanide and their tolerance to increasing levels of the compound. To evaluate each isolate's cyanide-degrading activities, isolates were grown in the simulated and actual effluent, and a titrimetric method was used to quantify residual cyanide over a number of days. Cyanide degradation efficiency (DE) was then calculated for each isolate. Identification of positive isolates involved 16S rRNA gene amplification and sequence analysis through BLAST. Six cyanide-utilising bacterial strains were isolated. Two of the isolates were identified as *Klebsiella* spp. while the other two were shown to be different strains of *Clostridium bifermentans*. All isolates showed normal growth in the presence of cyanide, with growth being inhibited at 700 mg/L cyanide and beyond. Cyanide degradation efficiency for all isolates in the simulated effluent ranged from 79% to 97%. All isolates were able to remove cyanide from actual gold mine effluent with very high DE values (90 - 94%) being recorded. Isolates obtained in this study were able to efficiently remove cyanide from both simulated and actual effluent. This observation clearly demonstrates the feasibility of the biological removal of cyanide from cyanide-rich gold mine effluents and should, therefore, motivate research towards the possible large-scale application of this technology.

Keywords : cyanide effluent, bioremediation, *Clostridium bifermentans*, *Klebsiella* spp, environment

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