

APPLICATION OF MICROBES FOR SURMOUNTING ACID MINE DRAINAGE IN AN ABANDONED COAL MINE: A CASE STUDY¹

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Abstract: Researchers have been striving to develop novel and innovative techniques for combating a host of remediation problems, especially in the mining sector. In general, contamination removal is a slow process. In this work, we study the incidence of Acid Mine Drainage (AMD), its causes and impact on the downstream side with reference to the case study of an abandoned Coal mine, having high sulfur contents, and under the administrative control of the State owned Coal India Ltd. The coal from this mine is of very good quality and its GCV ranges up to 8250 kCal/kg. To meet the ever growing coal demand, this Coal mine is now being planned to be re-opened. The formation exhibits the tertiary stratigraphy sequence. The UVM% ranges from 41.03 – 46.80 and total sulfur in the coal seam varies from 1.62% to 4.60%. The flip side of the high sulfur content, however, is the nagging problem of AMD which occurs when mining activity, under oxidizing conditions, brings sulfidic coal into contact with surface water or ground water. In this work, applicability of bioremediation technique to combat the problem of AMD, and the effectiveness of the microbes, specifically, Thiobacillus ferrooxidans, in surmounting this nagging problem are investigated. Based on the data available from the laboratory analysis, Thiobacillus bacteria was grown under prevalent initial pH of 2.0 and temperature of 30 deg. C. After sustained treatment and keeping the pH values amenable to the growth of this acidophilic bacteria (pH:1.5 to 2.0) which gets its energy primarily through the oxidation of Fe^{2+} , it was observed that Thiobacillus was able to effectively surmount the problem of AMD by adding alkalinity, using NaOH drips, and pushing the pH value up to 7.2 besides bringing down the sulfate content - due to microbial action, to less than 0.60% - from the initial recorded value of 2.0%. Based on this, general principles are formulated to describe the kinetics of the microbial action. On a hindsight, the consideration(s) for mine permitting, in such specific circumstances, are examined.

Additional Keywords: Acid Mine Drainage, Abandoned Coal Mine, Microbial Kinetics, Mine Permitting

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