A Review of the Impact of Water Quality on Mineral Processing Productivity: Necessity of Using Artificial Intelligence for Smart Mine Water Management

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ABSTRACT

Water is a key input component of the mining industry, one of the largest contributors to Australia's economy. Therefore, effective and smart water management methods play a crucial role in maintaining the productivity of mineral processing, especially the efficiency of the flotation unit, under changing climatic and operational conditions. Flotation is one of the most common methods used in the mineral processing unit and it is one of the biggest water-consumers on a typical mine site. This is a process for selectively separating hydrophobic materials from hydrophilic. The strategy for managing water in a mine site should incorporate multiple interconnected factors. The initial factor to examine is the water quantity, as a scarce or abundant resource. The second item is water quality. Numerous investigations suggest that both organic and inorganic pollutants can influence flotation efficiency in a manner that may be positive, negative, or neutral due to their impact on surface properties of minerals. However, there remains a research gap in the field of developing a powerful tool in order to quantitatively predict the effect of water quality on mineral processing productivity, with a specific focus on the flotation unit, and utilizing this tool for smart mine water management, with the aim of minimizing risks and maximizing the economic efficiency of mining sites. This paper offers a categorized review of studies exploring the impact of water quality, including organic and inorganic pollutants, on the flotation unit's performance. Furthermore, it evaluates the requirement for using artificial intelligence, as a robust tool, to establish a quantitative relationship between water quality and flotation unit performance and how the artificial intelligence can be utilized in smart and sustainable mine water management.