

# Magnesite-Derived Magnesium Hydroxide for Multifunctional Industrial Wastewater Treatment

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**Abstract**—This study presents the synthesis and application of magnesium hydroxide ( $\text{Mg}(\text{OH})_2$ ) derived from natural magnesite for treating various industrial wastewaters, including acid mine drainage (AMD), laundry greywater, and municipal effluent. Two adsorbents, prepared via water and magnesium acetate hydration routes, were evaluated through batch and fixed-bed column experiments. The materials effectively neutralized acidic AMD (pH 2.7 - 9.3) and significantly reduced electrical conductivity and total dissolved solids, meeting SANS 241:2015 standards in most cases. Column results confirmed  $\text{Mg}(\text{OH})_2$ 's scalability and stability, under continuous flow particularly for AMD treatment, highlighting its potential as a low-cost, sustainable neutralizing agent for industrial water remediation

**Keywords**—Acid Mine Drainage, Industrial Wastewater, Magnesium Hydroxide, Magnesite, Neutralization, Resource Recovery

Manuscript received October 24, 2025. This work was supported in part by the Technology Innovation Agency under Grant R056

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