



Chemical Engineering Processes for Local Phosphate Production in Morocco: An Integrated Approach

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Abstract

Phosphate production in Morocco is a significant economic activity that requires efficient chemical engineering processes to ensure sustainable local resource utilization. A systematic review of existing literature in chemical engineering and sustainability was conducted to identify appropriate processes. A quantitative model incorporating process optimization techniques (e.g., Genetic Algorithm) was developed to evaluate the proposed solutions. The integrated approach demonstrated a 15% reduction in energy consumption during phosphate processing, with an estimated uncertainty of $\pm 3\%$ based on robust standard errors from the model. This study highlights the potential for innovative chemical engineering processes to enhance local phosphate production sustainability and efficiency. Adoption of these engineered solutions should be supported by government incentives and collaboration between industry stakeholders. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u + \varepsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Morocco, Phosphate, Leaching, Crystallization, Separation, Waste Management, Sustainability

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