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

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Abstract

Morocco is a phosphate-rich country that aims to enhance local resource utilization in its chemical engineering processes for phosphate production. A comprehensive review of existing literature was conducted to identify suitable process models. A novel integrated approach combining thermodynamic calculations with a statistical design of experiments (DOE) was developed. This approach considers both qualitative data from pilot scale tests and quantitative data from laboratory studies to validate the model's accuracy and reliability. The optimization process revealed that an optimal temperature range for the reaction was between 350°C and 400°C, which led to a 20% reduction in energy consumption compared to the current standard practice. The integrated approach successfully identified the key parameters affecting phosphate production efficiency. The findings provide valuable insights into optimising local chemical engineering processes for sustainable phosphate production in Morocco. Based on the results, it is recommended that Moroccan industries adopt these optimised process models to enhance their operational efficiency and reduce environmental impact. Morocco, Phosphate Production, Chemical Engineering Processes, Optimization, Thermodynamics, Statistical Design of Experiments The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Morocco, Phosphate Production, Chemical Engineering, Sustainability, Process Optimization, Resource Utilization, Integrated Approach*

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