

Methodology for the Beneficiation and Acidulation of Moroccan Phosphate Rock

A Process Integration Framework

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ABSTRACT

Background: Morocco possesses the world's largest reserves of phosphate rock, a critical raw material for fertiliser and chemical industries. However, the beneficiation and subsequent acidulation processes for local phosphate production often operate in isolation, leading to suboptimal resource efficiency and increased environmental footprint. A systematic framework for integrating these unit operations is lacking.

Purpose and objectives: This article presents a novel process integration methodology to optimise the coupled beneficiation and acidulation of sedimentary phosphate rock. The primary objective is to develop a modelling framework that maximises overall P_2O_5 recovery while minimising reagent consumption and gypsum by-product generation.

Keywords: *Phosphate rock beneficiation, Acidulation process, Process integration, Moroccan phosphate, Resource utilisation, Chemical engineering methodology, North African minerals*

Article Highlights

- A systems engineering approach integrates mass and energy balance models for comminution, flotation, and acidulation.
- Predictive regression model for acid demand accounts for feedstock variability using robust standard errors.
- Sequential modular simulation identifies optimal process setpoints for coupled unit operations.
- Framework demonstrates significant gains in resource efficiency and process sustainability.

Core Innovation

A novel modelling framework that couples beneficiation and acidulation, moving beyond sequential optimisation to achieve systemic gains in P_2O_5 recovery and reagent efficiency.

This methodology offers a systematic, evidence-based approach for enhancing phosphate processing viability.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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