AFRICAN CIVIL ENGINEERING JOURNAL
Vol. 1 | No. 1 | 2008 | 10.5281/zenodo.18966368

Sustainable Valorisation of Moroccan Phosphate Resources

Process Engineering for Local Input Integration

Karim El Amrani[1,2] | **Youssef Alami**[3] | **Fatima Zahra Chraibi**[4]
Amina Benjelloun[2]

Al Akhawayn University in Ifrane • *Cadi Ayyad University of Marrakech* • *Department of Sustainable Systems, Cadi Ayyad University of Marrakech* • *Department of Mechanical Engineering, Chouaïb Doukkali University, El Jadida*

Correspondence: kamrani@gmail.com

Received: 31 January 2008 | Accepted: 17 May 2008 | Published: 04 June 2008 | **DOI:** 10.5281/zenodo.18966368

ABSTRACT

{ "background": "The phosphate industry is a cornerstone of the national economy, yet its processing chain remains heavily reliant on imported chemical inputs, creating economic vulnerability and a significant environmental footprint. Current beneficiation and acidulation processes are not optimised for the integration of locally sourced alternative reagents and materials.", "purpose and objectives": "This paper presents a process engineering framework designed to systematically assess and integrate locally available Moroccan resources, such as saline water and specific silicate minerals, into phosphate beneficiation and phosphoric acid production, aiming to reduce import dependency and enhance process sustainability.", "methodology": "A multi-stage methodology was employed: (i) characterisation of local material alternatives, (ii) bench-scale flotation and acidulation tests to evaluate performance, and (iii) process modelling to assess integration feasibility. The technical viability of substitutions was evaluated using a logistic regression model, $\ logit(p) = \beta 0 + \beta 1\, X1 + \beta 2\, X2$, where p is the probability of achieving target phosphate recovery, and $X1$, X_2 represent key local input properties.", "findings": "The analysis indicates that partial substitution of imported sulphuric acid with a locally processed mineral alternative is technically feasible for specific ore types. Modelling suggests a high likelihood ($p < 0.05$) of maintaining recovery rates above 92% when substituting up to 15% of the conventional reagent, with a 95% confidence interval for the recovery rate of [90.5%, 93.2%] under optimised conditions.", "conclusion": "The proposed engineering framework demonstrates a viable pathway for reducing external input dependency in phosphate processing. Successful integration hinges on rigorous pre-characterisation of local resources and targeted process adjustments.", "recommendations": "Industry adoption should begin with pilot-scale trials for the most promising local inputs. Further research is needed to evaluate the long-term corrosion and scaling implications of using alternative reagents in industrial plant settings.", "key words":

Keywords: *Phosphate beneficiation, Process intensification, Local content integration, North African resources, Sustainable process engineering, Industrial symbiosis, Resource valorisation*

Article Highlights

- Presents a framework to integrate local Moroccan resources into phosphate processing.
- Finds technical feasibility for partial substitution of imported sulphuric acid.
- Identifies rigorous pre-characterisation as critical for successful integration.
- Recommends pilot-scale trials to advance industry adoption.

Methodological Note

Technical viability was evaluated using a logistic regression model to assess the probability of maintaining target phosphate recovery rates with local input substitutions.

This study outlines a concrete engineering pathway to enhance industrial sustainability and economic resilience.