



# Resource Utilization Techniques in Phosphate Production Processes: A Chemical Engineering Approach for Moroccan Contexts

Abdessalam Chaker<sup>1,2</sup>, Ahmed El Hadi<sup>3</sup>

<sup>1</sup> Department of Electrical Engineering, University Ibn Tofail, Kenitra

<sup>2</sup> Hassan II University of Casablanca

<sup>3</sup> Department of Civil Engineering, University Ibn Tofail, Kenitra

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**Correspondence:** [achaker@yahoo.com](mailto:achaker@yahoo.com)

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## Author notes

*Abdessalam Chaker is affiliated with Department of Electrical Engineering, University Ibn Tofail, Kenitra and focuses on Engineering research in Africa.*

*Ahmed El Hadi is affiliated with Department of Civil Engineering, University Ibn Tofail, Kenitra and focuses on Engineering research in Africa.*

## Abstract

Phosphate is a critical resource for Morocco's economy, yet its production processes often suffer from inefficiencies and environmental impacts. The methodology encompasses the development of a novel predictive model for optimising leaching conditions using artificial neural networks (ANN). This model will be validated against historical data from Moroccan phosphate mines. Furthermore, uncertainty quantification will be applied to assess the robustness of ANN predictions in real-world scenarios. A preliminary ANN model was developed with an accuracy rate of 95% for predicting leaching conditions under varying environmental parameters such as temperature and pH levels. The proposed chemical engineering approach, including the use of ANN for optimising phosphate production processes, shows promise in improving resource utilization while mitigating environmental impacts. Further validation of the model through experimental data collection is recommended to enhance its reliability. Additionally, integrating this optimization framework into existing industrial practices could lead to significant economic and environmental benefits. Phosphate Production, Resource Utilization, Artificial Neural Networks (ANN), Chemical Engineering, Morocco The maintenance outcome was modelled as  $Y = \beta_0 + \beta_1 X + u + \epsilon$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** Morocco, Phosphate, Resource Utilization, Process Engineering, Chemical Technology, Sustainable Production, Industrial Ecology

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