

Investigating the Calco-Carbonic Balance of Drinking Water in Fes Morocco Using Principal Component Analysis and Multiple Linear Regression

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Abstract

The quality of drinking water is crucial for public health and the sustainability of distribution systems. This study investigates the calco-carbonic balance of drinking water in Fes, Morocco, employing two analytical methods: Principal Component Analysis (PCA) and Multiple Linear Regression (MLR). PCA is used to explore the interactions among various physicochemical parameters, while MLR aims to predict the Langelier Index (saturation index) based on these parameters. Through comprehensive data collection, this research highlights the complex interplay of factors influencing the calco-carbonic balance, vital for preventing scaling. Scaling can lead to significant operational challenges, including reduced water flow, decreased energy efficiency, increased maintenance costs, and potential deterioration of water quality. Key parameters identified as influential to the calco-carbonic balance include temperature, total hardness, dissolved oxygen, conductivity, pH, Complete Alkalinity Title (CAT), and the Langelier Index. The analysis produced a robust model with a coefficient of determination of 0.93 and a standard error of 0.03, indicating strong predictive capability. This study provides valuable insights into the chemical processes related to scaling and offers practical recommendations for water management practices, aiming to guide targeted interventions to maintain and enhance drinking water quality in Fes.

Keywords

Calco-carbonic Balance, Drinking Water Quality, Principal Component Analysis, Multiple Linear Regression, Langelier Index, Water Management, Scaling Prevention