African Metallurgy (Materials Focus - Applied Science/Tech)

Methodological Evaluation of Water Treatment Systems in South Africa: A Randomized Field Trial

Sipho Mkhize[1]

[1] Rhodes University

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Correspondence: smkhize@aol.com

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Author notes

Sipho Mkhize is affiliated with Rhodes University and focuses on Engineering research in Africa.

Abstract

Water treatment systems are critical for ensuring safe drinking water in South Africa, with varying degrees of effectiveness across different regions and facilities. A randomized controlled trial was conducted in 10 randomly selected municipalities. Water samples were collected at regular intervals, and data on pH levels, turbidity, and microbial content were analysed using linear regression models with robust standard errors for uncertainty quantification. The analysis revealed a significant difference ($p < 0.05$) in the mean pH levels between treated and untreated water samples, indicating that not all treatment systems achieve optimal disinfection. The results suggest that water quality improvements can be enhanced by optimising treatment protocols and increasing system maintenance frequency. Municipalities should prioritise regular system audits and upgrade outdated infrastructure to ensure consistent compliance with health standards. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, Africa, randomized-control-trial, Risk-Analysis, System-Architecture, Data-Analytics, Quality-Assurance*

ABSTRACT-ONLY PUBLICATION

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