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Wastewater Treatment Technologies' Impact on Water Quality in Rural Zimbabwean Communities: An Intervention Study

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Abstract

Wastewater treatment technologies (WWTTs) are essential for improving water quality in rural areas, particularly in Zimbabwean communities where sanitation infrastructure is often inadequate. The intervention study involved deploying and monitoring three types of WWTTs (aeration lagoon, constructed wetland, and ultraviolet light) in four randomly selected rural communities. Water samples were collected from influent and effluent to measure microbial indicators and chemical pollutants. A significant reduction ($p<0.05$) in total coliform counts was observed with the aeration lagoon system, while the constructed wetland showed a moderate decrease ($p=0.08$). Ultraviolet light treatment achieved nearly complete removal of pathogens (98% confidence interval: 95-99%). The study demonstrates that different WWTTs have varying efficacies in improving water quality, with ultraviolet light providing the most reliable pathogen reduction. Communities should prioritise the installation of ultraviolet light systems for wastewater treatment to ensure effective removal of pathogens and maintain safe drinking water supplies. Wastewater Treatment Technologies, Rural Communities, Water Quality Improvement, Pathogens Reduction Treatment effect was estimated with $text\{logit\}(\pi)=beta0+\vec{\beta}\,p\,X_i$, and uncertainty reported using confidence-interval based inference.

Keywords: *African Geography, Intervention Study, Public Health, Water Quality Monitoring, Wastewater Treatment Systems, Environmental Sanitation, Quantitative Analysis*

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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