

Title: Investigating The Presence of SARS-CoV-2 in Wastewater at Three Wastewater Treatment Plants in Gauteng, South Africa

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Abstract:

Introduction

The coronavirus disease (COVID-19) pandemic caused by widespread severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections, resulted in global alarm due to its high mortality rate and negative socio-economic impacts. Subsequently, SARS-CoV-2 genetic material detection in wastewater raised concerns over potential occupational exposure to wastewater treatment plant (WWTP) personnel and implications for water reuse.

Objectives

- Determination of SARS-CoV-2 RNA in wastewater and aerosols
- Comparison of viral load differences between samples from the different sampling/process points and treatment plants
- Evaluation of the infection potential of SARS-CoV-2 detected in wastewater and its implications for worker health and water reuse
- Determination of viral DNA/RNA pathogens present alongside SARS-CoV-2 in wastewater.

Methods

Samples (wastewater, contact surface swabs, and bioaerosols) were tested for SARS-CoV-2 RNA using real-time reverse transcriptase PCR, with positive samples subsequently analysed for SARS-CoV-2 RNA infectivity using Vero-E6 cells.

Results and Discussion

SARS-CoV-2 RNA was detected in 65% (111/172) of the samples. The percentages of positive detection varied between sample types, namely the influent (74%, 26/35), primary sludge (100%, 26/26), secondary settling tank effluent (71%, 20/28), activated sludge (66%, 19/29), final effluents (57%, 16/28), surface swabs (25%, 4/16) and bioaerosol (0%, 1/10) samples. The detected SARS-CoV-2 RNA concentrations across all three WWTPs ranged between 1.11×10^0 and 4.19×10^2 gene copy equivalents/ml, with viral RNA decay along treatment stages observed only in two plants. Infectivity tests showed no infection potential. Testing for other viral pathogens is still underway.

Conclusion

The presence of SARS-CoV-2 RNA in the final treated effluents suggests residual viral RNA persists despite wastewater treatment. However, infectivity studies suggest that SARS-CoV-2 loses viability in wastewater, indicating no direct evidence of health risks to WWTP personnel or during treated wastewater reuse.