Correlations between the oxidation-reduction potential characteristics and microorganism activities in the subsurface wastewater infiltration system

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ABSTRACT

The removal abilities in subsurface wastewater infiltration system (SWIS) rely heavily on the metabolism of microorganisms. Although the role of microorganism is appreciated, a lack of effective indicators of microbial function in SWIS is apparent. This study explored the correlations between oxidation-reduction potential (ORP) and microorganism and enzyme activities involved in nitrogen removal processes. The results showed that SWIS exhibited a gradual change in ORP level, microbial activity, and abundance along the soil profile. The quantities of nitrifier and denitrifier were in positive correlations with potential nitrification activity and denitrification activity \( p < 0.05 \). The correlation equations for ORP and nitrate reductase (NAR) activity were

\[
N = 1250 \text{ ORP} - 65.125 \quad (R^2 = 0.6165, \ p < 0.05),
\]

\[
N = 333.3 \text{ ORP} - 21.27 \quad (R^2 = 0.7508, \ p < 0.05)
\]

from the horizontal and longitudinal directions, respectively. The results suggested that ORP level could be used as an indicator of key functional microorganism and NAR activity involved in nitrogen cycling of SWIS. Furthermore, the distribution of ORP and aqueous rate behaved in the opposite way, confirming the running mechanism of SWIS theoretically.

Keywords: Subsurface wastewater infiltration system; Sewage treatment; Enzyme activity; Microorganism activity; Oxidation-reduction potential

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