

The effect of air supply on nitrogen removal using a biological filter proposed for ventilated pit latrines

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Abstract

Pit latrines are the most commonly used sanitation systems in many developing countries. Various researchers have reported elevated nitrate concentrations in groundwater in the vicinity of pit latrines and this could pose a serious health risk to the users of the water source. Faecal sludge from pit latrines contains high concentrations of nitrogen and organic matter (3-5 g·ℓ⁻¹ N and 20-50 g·ℓ⁻¹ COD); however, it is produced at a very low rate (1.5 ℓ·capita⁻¹·d⁻¹) relative to that of waterborne sewage systems. A pit latrine basically only confines the waste and no real treatment takes place. In this research the nitrogen was removed in a biological filter using a combination of nitrification and denitrification processes. The aim of this investigation was to determine the effect of air supplied at different rates, namely, 0, 0.3, 1.0 and 2.0 m³·h⁻¹ N, on the biological filtration process. The application rate was 0.04 m³·m⁻²·d⁻¹.

More than 90% removal of nitrogen was observed at an air supply rate of 1.0 m³·h⁻¹ N. At lower air supply rates nitrification was not complete. At an air supply rate of 2.0 m³·h⁻¹ nitrogen removal was also approx. 90%, but the biological filter only became stable after about 2 months of operation, possibly due to desiccation of the biomass.

Keywords: High nitrogen concentrations, nitrification, denitrification, biological filter