Inactivation of Bacteria And Viruses In Human Urine Depending On Temperature And Dilution Rate

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Abstract

Source separation and reuse of human urine decreases the environmental pollution of recipient waters and reduce the need for anthropogenic mineral fertilisers. At the same time the reuse of urine introduce another pathogen transmission route that needs to be managed. The inactivation of enteric pathogens and model organisms (*Salmonella* Typhimurium, *Enterococcus faecalis*., bacteriophages *S.* Typhimurium 28B, MS2 and Φx 174) by urine storage were studied at dilutions (urine:water) 1:0, 1:1 and 1:3 at temperatures 4, 14, 24 and 34/37°C. A threshold concentration of ammonia was found at approximately 40 mM NH_3 (e.g. 2.1 g NH_3-N L^{-1} and pH 8.9 in 24°C) where all studied organisms, except salmonella, considerably increased their survival below that concentration, irrespectively the treatment temperature. For *Salmonella* spp. no threshold level was found in these studies, with the lowest free ammonia concentration of 14 mM. This shows that the dilution rate is of big importance, especially at temperatures ≤24°C where the effect of low ammonia concentrations are large. At temperatures below 20°C, the reduction of the viruses was reduced to a very slow rate. Thereby, urine stored at temperatures below 20°C holds high risk for containing viable viruses. The present study confirmed the current guidelines that storage of urine for 6 months at 20°C is safe for unrestricted use.

Keywords: Ammonia, bacteriophages, *Enterococcus* spp., inactivation, pathogens, *Salmonella* spp., sanitisation, temperature, urine.

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