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EFFECT OF TRANSMITTANCE AND SUSPENDED SOLIDS ON THE EFFICACY OF UV DISINFECTION OF BACTERIAL CONTAMINANTS IN WATER

by

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ERRATA

Additional information

- page 18 line 23 **NTU** refers to nephelometer transmission units.
- page 20 line 27 **MPN** refers to a most probable number estimate of numbers of bacteria.
- section 3.4 page 42. Water samples were not filtered to remove Celite. Removal of Celite by centrifugation could have resulted in loss of bacteria from the suspending water and underestimation of numbers of surviving (viable) bacteria.
- section 4.5 page 75 line 12. *following* "... initial cell numbers" insert "(*see* page 54 also Table 4.4)"
- Appendix F page 96. *following* the summary table insert "The summary table shows clearly that the water flow in the UV unit is turbulent."

Corrections

- page2 line 11,12; page 6 line 6; page 22 line 15; page 41 line 5 and 6; page 62 Table 4.5 change "absorption" to "absorbtion".
- page 4 line 15 change "... of the efficacy of disinfection systems is the total viable faecal numbers of coliform bacteria." to "... of the efficacy of disinfection is the total number of viable faecal coliforms in the system."
- page 8 Figure 2.3 change "thymidine" to "thymine"
- page 18 second dot point change ".. afford protection ..." to "... are protected ..."
- page 22 line 2 change "... clumps larger than 70 μm caused a major obstacle to inactivating more than ..." to "... clumps larger than 70 μm restricted inactivation to ..."
- page 23 line 22 *following* "... 2 to nearly 8" insert "... 2 to nearly 8 $\log_{10}$"
- page 51 last sentence *following* "... from 0.074% to 0.26% ..." should read "... from 0.074 to 0.026% ..."

Typographical errors

- page 2 second dot point no italics for "and"
- page 2 third dot point no italics for "transmittance"
- page 15 second sentence delete "that"
- page 16, 20, 24 "Schieble *et al.* 1986" should read "Schieble 1986"
- page 18 second dot point no italics for "clumping"
- page 41 line 10 "Mann, 1992" should read "Mann & Cramer, 1992"
- page 59 para. 2 line 4 "Qualls *et al.* 1985" should read "Qualls *et al.* 1989" and "Job *et al.* 1995" should read "Job & Realey"
- page 111 "and" and not "aand"

Order of References

Sabotka 1992 should be listed before Sobottka 1993, *also* Cairns 1993 before Cairns 1995

Additional Reference

page 37 Stanier *et al* 1972: Stainer, R. Y., Doudoroff, M. and Adelberg, E. A. 1972. *General* Microbiology, 3rd Edn., The Macmillan Press Ltd., London.

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Mrs Ha Thi Nguyen:

Date: 17 March 1999

SUMMARY

Irradiation with ultraviolet light is an effective means for disinfection of contaminating bacteria in potable water and waste-water. However high levels of turbidity and suspended solids (SS) can limit UV efficacy. Little quantitative data however are available. To obtain robust and quantitative data on the influence of UV absorption and SS on UV disinfection an experimental study using commercial disinfection technology was undertaken. The acquisition of data is justified by an increased confidence in application and understanding and as a necessary step to process optimisation.

A commercial disinfection unit (UV-LC5™ from Ultraviolet Technology of Australasia P/L) was operated with a range of feed water low rates (1 - 4 L min^{-1}) and which contained either *Escherichia coli* ATCC 25922 or *Pseudomonas aeruginosa* as selected test micro-organisms. *E. coli* was selected because this is found in sewage or water contaminated by faecal material, is used as an indicator for presence of other enteric pathogens and it should be absent in potable water. *P. aeruginosa* was used as a test bacterium primarily because it has DNA comprising relatively high molar ratios of guanine (G) and cytosine (C) and is therefore more resistant to inactivation by UV light than *E. coli.* UV dosage (6,500 - 25,000 $\mu W.s.cm^{-2}$) was altered by controlling the flow rate of feed water into the disinfection unit. The transmittance of feed water (at 254 nm) was adjusted by addition of a UV absorbing agent (International Roast ™ coffee-powder), or by adjusting turbidity using diatomaceous earth as a suspended solid (SS) (Celite 503™ - 0.01 to 0.1 g L^{-1}, median particle size of 23 μm).

Reductions in the number of viable bacteria of between 3 log_{10} and 5 log_{10} were obtained. Survival of the test micro-organisms was greatest at the highest flow rates used and inversely proportional to UV transmittance of the feed tank water, irrespective of the method by which transmittance was adjusted. However, at equivalent transmittance, Celite provided greater protection against disinfection than addition of a UV absorbing agent. In both dark and light storage post irradiation, the re-growth and repair rate of *E. coli* was greater than for *P. aeruginosa*. Following a six (6) day storage the number of *E. coli* reached nearly 25% of the initial number in un-irradiated water. This work highlights the impact of water quality on the use of small scale UV disinfection units for preparation of potable water, where operating parameters should be based on a knowledge of the presence of soluble UV absorbing agents and of SS.

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I hope that the results of my efforts justify the expectations and confidence of the people concerned, and the interest, help, and encouragement of my family, friends and colleagues.

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