

INTERACTION OF FERROUS IONS AND FREE CHLORINE ON MICROBIOLOGICAL QUALITY OF DRINKING WATER

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University of Peradeniya has a nearly 60 year's old water distribution network that consists mainly iron pipelines, most of which are now corroded to a large extent, adding iron rust to water. The aim of this study was therefore to investigate the possible consumption of free chlorine that added in to water for disinfection by iron dissolved from pipes. If free chlorine is reduced due to iron, the available amount of free chlorine would not be sufficient for the disinfection of microorganisms in water.

A laboratory simulated study was carried out to investigate the possible reaction between ferrous ion (Fe^{2+}) and free chlorine in water using a series of Fe^{2+} and free chlorine mixtures. The effect of the reaction on the inhibition of microorganisms were also determined by spiking *Serratia spp.* (a total coliform) and *Escherichia coli* (a fecal coliform) into known mixtures of Fe^{2+} and free chlorine. The Fe^{2+} and free chlorine contents were measured spectrophotometrically while viable microbial count was assessed using membrane filtration technique that followed a confirmation tests. Furthermore Fe^{2+} , free chlorine and microbiological quality were determined periodically using 27 water samples that were collected from various points of the University network.

The results of this study indicated a rapid reaction between Fe^{2+} and free chlorine. The rate of free chlorine reduction was directly proportional to the amount of Fe^{2+} in water. Although inhibition of *Serratia spp.* and *E. coli* was observed due to free chlorine in water, the effect reduced drastically with increasing Fe^{2+} in water. *Serratia sp.* decreased gradually with the ascending chlorine levels at Fe^{2+} levels of 0.2 and 1.0 mg/L. Total inhibition of *Serratia sp.* were observed at 2 and 3 mg/L of Fe^{2+} while *E. coli* was inhibited at Fe^{2+} levels of 1.0, 2.0 and 3.0 mg/L. The Fe^{2+} content in the water distribution network of University of Peradeniya were ranged from <0.01 mg/L to 0.64 mg/L (desired value is <0.3 mg/L), while the desired free chlorine level (0.2 mg/L) was observed only at two locations (Faculty of Veterinary Science and Meewathura treatment plant). Total coliforms were detected in samples collected from Upper Hanthana, Marcus Fernando Hall, University Temple, Science Faculty, Mars Hall and Medical Faculty, while fecal coliforms were detected only in a sample from Marcus Fernando Hall. The results of microbiological test showed that water distributed from the Kandy Municipal Council and Meewathura plants are suitable for drinking, but water distributed from the Upper Hanthana plant was not suitable for human consumption according to the World Health Organization (WHO) Standards (0/CFU per 100 ml for both total and fecal coliforms) and Sri Lankan Standards (3/CFU per 100 ml for total coliforms and 0/CFU per 100 ml for fecal coliforms). The possible reason behind the unsuitable microbiological quality of water may be related to the reaction between Fe^{2+} and free chlorine in water. It was also noted that, a high level of Fe^{2+} in water was inhibitory to microorganisms in water and remove bacteria by formation of clumps.