SCHOOL OF WATER SCIENCES

MRes Thesis
Academic Year 1995-1996
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Magnetic treatment of swimming pool water for enhanced chemical oxidation and disinfecting.

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September 1996

ABSTRACT

Magnetic water treatment is potentially of great benefit to pool water treatment in terms of the reduction in use of oxidizing chemicals in water treatment. Magnetic treatment has been variously shown to stabilize solution pH, eliminate corrosion of materials and reduce system downtime. In addition to the reduction in running costs, physical water treatment is generally viewed as being more environmentally acceptable; reducing the use of the strong oxidizing chemicals conventionally employed for disinfecting.

This study determines the efficacy of a magnetic treatment device on the inactivation of a model micro-organism (Escherichia coli), chlorine consumption and concomitant disinfecting by product formation in a swimming pool water analogue. Effects of magnetic water treatment on physical parameters such as scale deposition; conductivity and pH are reported, as well as the key performance determinands of chlorine consumption, micro-organism inactivation rate and trihalomethane (THM) formation. A commercially available magnetic treatment device (Magnetizer) was used throughout.

It was found that in all cases chlorine loss was more rapid in the control than in the magnetically treated water. The bactericidal efficiency of the free chlorine was unaffected by magnetic treatment, such that the E. coli kill rate for a given disinfectant dose was increased by an average of 25% by this physical conditioning. In addition, it was found that generation of THMs was reduced by magnetic treatment at any one free chlorine level.

ACKNOWLEDGMENTS

I would like to thank the representatives of Magnetizer in the UK for the sponsorship of this project,.

I would also like to thank my supervisor, Dr. Simon Parsons, and Dr. Simon Judd for their assistance.

MAGNETIC TREATMENT OF SWIMMING POOL WATER FOR ENHANCED CHEMICAL OXIDATION AND DISINFECTING.

1 INTRODUCTION

1.1 Background

Many industries, including the swimming pool industry, are being urged by regulatory bodies such as PWTAG and pressure groups to use non-chemical treatment processes wherever possible

Mean chloroform concentrations after an initial free chlorine dose of 0.4 ppm

ANCOVA of mean chloroform concentrations at 0.4 ppm initial dose

Source of Variation Sum of Squares DF Mean Square F Sig of F
CovariatesCombined CI (ppm)Free CI (ppm)PHTemperature (°C)Time (hours)
1.0900.9760.1901.76975.514 11111 1.0900.9760.1901.76975.514 0.3070.2750.0530.50721.298
0.0580.6010.8180.4790.000
Main EffectPresence of MTD 20.429 1 20.429 5.660 0.000
ExplainedResidualTotal 120.415283.651404.006 68086 20.0693.5464.698 19.000 0.000

Summary of effects of MWT

1) The pH of pool simulant solutions increased when organic compounds were present and decreased when they were absent.
2) No changes in solution conductivity were found.
Magnetizer comment: This is to be expected since there was no evaporative water loss.
3) No scale was formed, so no conclusive results were obtained.
Magnetizer comment: With virtually no make up water or loss, scaling could not be significant.
4) The turbidity of the solutions increased by an undetermined amount.
Magnetizer comment: If a filter would have been used in the test rig, particles could have been filtered out.
5) No direct biocidal effects were observed.
Magnetizer comment: Test was only run in 8 - hour day shift.
6) The cell death rate of E coli was significantly raised owing to increased aqueous chlorine.
7) Concentrations of free chlorine in solution were significantly increased by MWT at 0.8 and 1.2 ppm free chlorine doses.
8) Concentrations of combined chlorine in solution were significantly increased by MWT at and 1.2 ppm free chlorine doses.
9) Cell kill was improved at 0.4, 0.8 and 1.2 ppm initial free chlorine doses.
10) Chloroform production was suppressed at 0.4 and 1.2 ppm initial free chlorine doses; at 0.4 ppm this was significant.