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Fine bubble technology — Water treatment applications —

Part 2: Test methods using *Escherichia coli* as a test micro-organism

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Contents

Page

Foreword ... **iv**
Introduction ... **v**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 Safety precautions ... **2**
5 Requirements ... **2**
6 Test methods ... **2**
6.1 Principle ... 2
6.2 Test facility ... 2
6.3 Culture media and reagents ... 2
6.3.1 General ... 2
6.3.2 Water ... 2
6.3.3 Tryptone soya agar (TSA) ... 3
6.3.4 Tryptone soya broth (TSB) ... 3
6.3.5 Lysogeny broth (LB) ... 3
6.3.6 Cryoprotective solution for bacterial species ... 3
6.3.7 Physiological saline ... 4
6.3.8 Tryptone sodium chloride solution (TSCS) ... 4
6.4 Laboratory apparatus and glassware ... 4
6.5 Preparation of bacterial test suspension ... 5
6.5.1 Storage of strains ... 5
6.5.2 Working culture of test bacteria ... 5
6.5.3 Bacterial test suspension ... 6
6.6 Procedure ... 6
6.6.1 Choice of experimental conditions ... 7
6.6.2 Test procedure for antibacterial activity ... 8
6.7 Calculation and expression of results ... 9
Annex A (normative) **Strain numbers** ... **10**
Annex B (normative) **Shaking method** ... **11**
Annex C (normative) **Luminescence photometers and RLU** ... **12**
Annex D (informative) **Test report of interlaboratory tests for disinfection efficiency of fine bubbles** ... **13**
Bibliography ... **21**

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Foreword

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This document was prepared by Technical Committee ISO/TC 281, *Fine bubble technology*.

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Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

In the last decade, fine bubble technology generated by hydrodynamic cavitation methods has been applied as part of water treatment facilities for water disinfection purposes. However, absence of International Standards in relation to the efficiency of water disinfectant properties on fine bubbles has been an obstacle to trading and technology transfer. This document describes a method for the determination of water disinfection efficiency of fine bubbles generated by a hydrodynamic cavitation.

Fine bubbles act as a disinfectant through chemical (i.e. generation of OH radicals) and physical mechanisms caused by presence of shock waves, pressure gradients and shear forces. The function as a disinfectant of fine bubbles was also found in that fine bubbles provide a more effective means for cleaning and disinfecting both, the bath and the reservoir, than traditional ultrasonic vibrator.[1]

Properties of fine bubbles and their disinfection mechanisms differ according to applied generation processes, bubble size distributions and bubble densities. However existing studies showed that fine bubbles generated have a significant water disinfection effect. Particularly, high deactivation efficiency of *Escherichia coli* (*E. coli*) has been achieved in water disinfection by microbubbles generated using hydrodynamic cavitation as well.[2]-[4]

Generation of highly reactive free radicals and turbulence associated with collapsing micro bubbles provides great potential for water disinfection. The effect of ozone microbubble on *E. coli* has often been found more effective and with faster disinfection kinetics of *E. coli*, when the ozone gas is activated as the micro or ultrafine bubble forms.[5],[6]

The test methods on the antibacterial activity of textile products have been standardized by ISO/TC 38, *textiles*. The present standard operation procedure (SOP) for the evaluation of disinfection efficiency is based on the quantitative measurement by ATP luminescence method for the evaluation of antibacterial activity.

Therefore, under the test conditions, establishment of International Standards to measure the water disinfection efficiency of fine bubbles is essential to promote the relevant trading technology transfer.

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Fine bubble technology — Water treatment applications —

Part 2:
Test methods using *Escherichia coli* as a test micro-organism

1 Scope

This document specifies a test method for assessing bactericidal viability of *Escherichia coli* as a test micro-organism, in dispersions of various fine bubbles generated by the hydrodynamic cavitation of water medium.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
hydrodynamic cavitation
fine bubble generation method used by physical hydrodynamic structures and pressures

3.2
disinfection efficiency
ratio of viable cell count to the initial number of the test bacteria

3.3
control suspension
suspension used to validate the growth condition of test bacteria and validate the test, i.e. bacterial test suspension produced without using fine bubble generation

3.4
test solution
solution samples obtained for the analysis of antibacterial activity after operating the test facility

3.5
test gas
gas mixed in the middle of operating the cavitation unit

3.6
relative light unit
RLU
unit used for adenosine triphosphate (ATP) luminescence measurement

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