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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 44376.1-2024

**Fine bubble technology - Water treatment applications - Part 1:
Test method for evaluating ozone fine bubble water generating
systems by the decolorization of methylene blue**

微细气泡技术 水处理应用 第1部分：亚甲基蓝脱色法评价臭氧微细气泡水发生系统

(English Translation)

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting is required.

This document is part 1 of GB/T 44376 "Application of Microbubble Technology in Water Treatment". GB/T 44376 has been published as follows part.

Part 1: Evaluation of ozone fine bubble water generation system by methylene blue decolorization method.

This document is modified to adopt ISO 20304-1:2020 "Application of microbubble technology in water treatment - Part 1: Evaluation of methylene blue decolorization method" Price ozone fine bubble water generation system.

Compared with ISO 20304-1:2020, this document has many structural adjustments. A list of structural number changes between the two documents See Appendix A for the table.

The technical differences between this document and ISO 20304-1:2020 and their reasons are as follows.

GB/T 41914.1 replaced ISO 20480-1 (see Chapter 3, Chapter 3 of ISO 20304-1:2020) to adapt to my country Technical conditions to improve operability;

The definition of the term "fine sparkling water" (see 3.1, 3.1 of ISO 20304-1:2020) has been changed to adapt to the technical requirements of my country.

condition;

Added the terms and definitions "ozone concentration" and "ozone dosage" (see 3.5 and 3.6) to improve operability; -Added explanation of the principle of ozone decolorization and suggestions on reducing the influence of bubbles on measurement (see 4.1) to improve the understanding of this document.

Improve operability;

The recommendation to use an online absorbance meter (see 4.1 of ISO 20304-1:2020) has been deleted to improve operability.

Sexuality;

The temperature of the test chamber has been changed (see 4.2 of ISO 20304-1:2020) to improve operability;

The "circulation pump and measuring instrument unit for online measurement" (see 4.6 of ISO 20304-1:2020) was deleted and the "circulation pump and measuring instrument unit for online measurement" was added "Ozone Bypass Detection Unit" (see Figure 1) to improve operability;

Change "residual ozone treatment unit" to "residual ozone tail gas treatment unit" (see 4.3, 4.7, ISO 20304-1.

4.3 and 4.7 of 2020), which are more in line with domestic expressions;

Added instructions for the selection of reaction conditions and gas flowmeter during the test [see 4.5 a) and 4.9 f)] to apply to offline Measurement to improve operability;

The requirements for ozone flow rate have been changed [see 4.5 a), 4.5 a) of ISO

20304-1:2020], and the requirements for ozone concentration have been added.

See 4.5 a)], added the corresponding operation steps for ozone bypass detection [see 4.5 a)] and the treatment measures before the experimental solution test [See 4.5 c)] to improve operability;

The description of the gas pressure gauge [see 4.5 a) and 4.9 e) of ISO 20304-1:2020] has been deleted to adapt to the technical requirements of my country.

Item;

Added the operation steps of stirring and fixing the sampling points during the experiment [see 4.6 b)], changed the number of sampling points, the experimental weight, the number of replicates, sampling requirements, and blank control group [see 4.6 c), 4.6 h of ISO 20304-1:2020)] are required to improve operability.

Sexuality;

The description of the circulation pump for absorption measurement [see 4.6 g of ISO 20304-1:2020)] has been deleted to improve operability;

GB/T 41914.2-2022 replaces ISO 20480-2:2018 [see 4.8 a), 4.6 c) of ISO 20304-1:2020], to adapt to my country's technical conditions and improve operability;

The quality of the methylene blue powder for preparing the mother solution [see 4.8 c), 4.6 e) of ISO 20304-1:2020] and the acidity and alkalinity of the solution have been changed.

The range of degrees [see 4.8 d), 4.6 f) of ISO 20304-1:2020] to improve operability;

Change the "change of absorbance over time" in the evaluation object to "the absorbance of the test solution changes with the increase of ozone dosage" "(see 5.1, 5.1 of ISO 20304-1:2020) to improve operability;

Change the evaluation from the change of concentration over time to the change of concentration over the ozone dosage (see 5.2, ISO 20304-1.5.2 of 2020) to improve operability;

Added the calculation formula of ozone dosage [see 5.2 b)] to improve operability; -Replace the horizontal axis with the ozone dosage and the experimental data (see Figure 2, Figure 2 of ISO 20304-1:2020), to adapt to the technical conditions of our country;

Added the requirement for goodness of fit R^2 in the fitting curve [see 5.2 e)] to improve operability; -Added experimental record of decolorization effect. Added ozone dosage and ozone standard flow rate at half-life $t_{1/2}$ in the experimental description [see Chapter 6 f)] to improve operability;

The characteristics of fine bubbles (size and number concentration of fine bubbles) have been deleted [see Chapter 6 and

h) of Chapter 7] to adapt to my country's technical conditions and improve operability.

The following editorial changes were made to this document.

GB/T 35804 replaces the informative reference ISO 1431-3; -the informative annexes A and B of ISO 20304-1:2020 were deleted, and informative appendix B "Different test systems in different

Example of absorbance test results at the same ozone dosage".

Introduction

Ozone is often used to improve water quality, such as decomposing and decolorizing substances in water that are difficult to purify and decompose. The conventional method is to use porous Tube/sheet system. However, research has found that using fine ozone bubbles may help to more effectively utilize the strong oxidizing properties of ozone.

In recent years, the development of micro-bubble generation technology has made the utilization efficiency of ozone higher than that of porous tube/plate systems. The improvement in efficiency helps Reduce costs.

Decolorization is mainly used to treat factory wastewater, recycled water and sewage. In addition, decolorization is also a routine operation in sewage treatment facilities, such as for deep treatment of printing and dyeing wastewater, etc.

GB/T 44376 "Application of Micro-bubble Technology in Water Treatment" aims to provide a general reference for the application of micro-bubble technology in water treatment.

It is intended to be composed of two parts.

Part 1: Evaluation of ozone fine bubble water generation system by methylene blue decolorization method.

Test method for performance of ozone fine bubble water generating system.

Part 2: Test method using Escherichia coli as a test microorganism. The purpose is to establish the use of Escherichia coli as a test microorganism Test method for evaluating the bactericidal activity of fine bubble water produced by hydrodynamic cavitation.

Micro bubble technology water treatment application Part 1: Evaluation of the methylene blue decolorization method Ozone fine bubble water generation system WARNING-Persons using this document should be familiar with normal laboratory operations. This document does not purport to address all safety concerns associated with its use.

It is the user's responsibility to establish appropriate safety and health practices and to determine any other applicable limitations.