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Fine bubble technology — Agricultural applications —

Part 3: Guidelines for the minimum viable number concentration of ultrafine bubbles for promoting the germination of barley seeds

Technologie des fines bulles — Applications agricoles —

Partie 3: Lignes directrices relatives à la concentration minimale en nombre viable de bulles ultrafines pour favoriser la germination des graines d'orge

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Test subjects **2**
5 Judgement of significant difference in T_{50} **2**
6 Seeds and measurement device **2**
6.1 Seeds for germination test 2
6.2 Measurement device for UFB size and concentration 2
6.3 Examination range of UFB number concentration 2
7 Measurement data **2**
7.1 Necessary storage period of barley seeds longer than that of dormancy breaking 2
7.2 Germination promotion effects in association with each number concentration of UFB and the storage period of seeds 3
7.3 Results of the data analyses 4
7.3.1 Typical example 4
7.3.2 Analyses results of the remaining data (No. 2, 3, 4, 6, 7, 9, 10 and 11 in Table 1) 8
8 Suggestion **20**
Annex A (informative) **Example of measured data of size distribution and number concentration of UFB** **21**
Bibliography **23**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

A list of all parts in the ISO 23016 series can be found on the ISO website.

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

The market for technologies using fine bubbles have been rapidly growing in many applications throughout the industrial, domestic and academic sectors. Most notably, the applications of ultrafine bubble (UFB) technology to the agricultural area are drawing very high interest as they are thought to be part of the key technologies improving the productivity and efficiency of agriculture. Consequently, this contributes to the promotion of the United Nations Sustainable Development Goals (SDGs) in terms of providing sufficient food and maintaining water resources on land, for example.

As part of the strategy for standardizing the agricultural applications of fine bubbles, ISO 23016-2 was published, describing the test method for promoting barley seed germination by application of a UFB water generation system. Although UFB number concentration is closely related to the promotion of barley seed germination, the effects of concentration were not specified in it.

For the practical application of UFB technology to seed germination, it is important to provide data specifying the minimum number concentration of UFB necessary for promoting seed germination. This data provides useful information to users in their selection of an appropriate UFB generation system.

This document describes the collected data indicating the experimental observations between various number concentrations of UFB and their promotion effects on barley seed germination.

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Fine bubble technology — Agricultural applications —

Part 3: Guidelines for the minimum viable number concentration of ultrafine bubbles for promoting the germination of barley seeds

1 Scope

This document demonstrates guidelines for promoting the germination of barley seeds with a lower number concentration of ultrafine bubbles (UFB). This is achieved by taking the data concerning the germination ratio of barley seeds conforming to ISO 23016-2 as a starting point and then evaluating the minimum number concentration range of ultrafine bubble water necessary for promoting the effect on germination of barely seeds by changing germination time.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 23016-2, *Fine bubble technology — Agricultural applications — Part 2: Test method for evaluating the promotion of the germination of barley seeds*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 23016-2 and the following apply.

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

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

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

3.1
median germination period
T_{50}
time where the inferred germination ratio marks 50 % of the maximum germination ratio

Note 1 to entry: See Reference [1].

3.2
storage period
time length when barley seeds are stored under 20 °C

3.3
dormancy
failure of an intact viable seed to complete germination under favourable conditions

Note 1 to entry: The related term 'dormancy breaking' describes the breaking of dormancy. See Reference [2].

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