



BSI Standards Publication

**Marine technology — Marine environment
impact assessment (MEIA) — On-board
bioassay to monitor seawater quality using
delayed fluorescence of microalga**

National foreword

This British Standard is the UK implementation of [ISO 23734:2021](#).

The UK participation in its preparation was entrusted to Technical Committee SME/32, Ships and marine technology - Steering committee.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2021
Published by BSI Standards Limited 2021

ISBN 978 0 539 03794 4

ICS 13.020.30; 47.020.01

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2021.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

INTERNATIONAL STANDARD

ISO
23734

First edition
2021-07-27

Marine technology — Marine environment impact assessment (MEIA) — On-board bioassay to monitor seawater quality using delayed fluorescence of microalga



Reference number
ISO 23734:2021(E)
Documents
Document Sharing Hub
© ISO 2021



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Principle	2
5 Materials	3
5.1 Test alga	3
5.2 Reagents	3
5.2.1 Water	3
5.2.2 Growth medium	3
5.2.3 Nutrient, metal and tris stock solutions	3
6 Apparatus	4
6.1 General	4
6.2 High sensitivity luminometer	4
6.3 Incubator and tube shaker	4
6.4 Apparatus for determining algal cell density	4
6.5 Culture tubes	4
6.6 Clean bench	4
7 Preparations at a land-based laboratory	4
7.1 Preparation of the growth medium	4
7.2 Preparation of the algal stock culture	5
8 Test procedure on-board	5
8.1 Preparation of the algal inoculum culture	5
8.2 Choice of the test concentrations	5
8.3 Preparation of the test medium	5
8.4 Inoculation and incubation	6
9 DF measurement	6
10 Interpretation of data	6
10.1 Plotting the DF decay curve	6
10.2 Calculation of per cent inhibition	6
11 Interpretation of the results	7
12 Test report	7
Annex A (informative) Schematic overview and procedures of the on-board bioassay	9
Annex B (informative) Preparation of the test medium in seawater	12
Annex C (informative) Practical procedures for the on-board bioassay and schematic diagram of the high sensitivity luminometer	13
Annex D (informative) Cryopreservation procedure	14
Annex E (informative) Reference data for checking the appropriateness of the test procedures	15
Bibliography	16

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 organisations, 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 8, *Ships and marine technology*, Subcommittee SC 13, *Marine technology*.

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.

Introduction

Mining of offshore mineral resources has attracted much interest. These resources can be utilized as potential mineral resources. However, deep-sea mining of the seafloor can pose potential hazards to deep-sea environments and ecosystems (see [ISO 10253](#) and References [3], [19], [21]). One concern is the toxicity of heavy metals released from excavated minerals. Such heavy metals can be released into the seawater of the deep marine ecosystem[[7](#)],[[18](#)]. Further, there is a risk of unexpected leakage of the recovered minerals and mining wastewater from the mining plant, which can result in heavy metal contamination of the surface seawater[[8](#)].

Considering the above, an appropriate scheme for the monitoring and evaluation of the quality of deep and surface seawater can ideally be introduced at each deep-sea mining site. The International Seabed Authority (ISA) states that environmental impact assessments should address not only areas directly affected by mining, but also the wider region impacted by discharged plume and materials released during mineral transport to the surface[[8](#)].

An on-board or onsite method for heavy metal evaluation is essential, as it would allow prompt action in case of an unexpected pollution incident. Rapid evaluation of the nature and extent of pollution provides an opportunity to prevent wider spread of the toxic contaminants and, consequently, minimize idle periods of a mining plant.

Although many chemical analytical methods are available at land-based laboratories, few methods have been developed for on-board application. Deep-sea mineral deposits are inhomogeneous and can be the source of release of various types of metal elements. Therefore, evaluation of mining contaminants requires simultaneous analysis of multiple elements. Special instruments are needed to perform such analyses, such as inductively coupled plasma mass spectrometry. Further, these instruments have to be operated by expert staff, require considerable laboratory space and are expensive to install. Such instrument types are difficult to install at every mining site as standard equipment for environmental monitoring.

Bioassays constitute an alternative approach to specialist equipment, and are commonly used to assess ecological risks of chemical contaminations (see [ISO 10253](#)). Bioassays do not provide quantitative information about the contaminating substances, but can be used to detect a wide spectrum of toxicants, including unknown toxicants. This feature is advantageous for the monitoring of water quality during deep-sea mining activities.

General bioassay test protocols that use a variety of aquatic organisms have been published by organisations, such as ISO (see [ISO 10253](#)), the Organization for Economic Co-operation and Development (OECD) and the United States Environmental Protection Agency (US-EPA). These authorized protocols are accepted in various water quality management fields. However, similarly to chemical analyses, they require a considerable amount of time and space, and are thus not suitable for on-board monitoring. It should also be noted that most protocols have been developed for inland freshwater quality assessments.

This document was developed to address the shortcomings of the currently available bioassays for monitoring seawater quality on-board. It describes a bioassay specifically for on-board determinations.

This page deliberately left blank