
**Nanotechnologies — Method to
estimate cellular uptake of carbon
nanomaterials using optical
absorption**

*Nanotechnologies — Méthode d'estimation de la captation cellulaire
des nanomatériaux carbonés par mesure d'absorption optique*

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/TS 23034:2021](https://standards.iteh.ai/catalog/standards/iso/b7e18bb6-1544-4904-aca4-27115f206673/iso-ts-23034-2021)

<https://standards.iteh.ai/catalog/standards/iso/b7e18bb6-1544-4904-aca4-27115f206673/iso-ts-23034-2021>



iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO/TS 23034:2021](https://standards.iteh.ai/catalog/standards/iso/b7e18bb6-1544-4904-aca4-27115f206673/iso-ts-23034-2021)

<https://standards.iteh.ai/catalog/standards/iso/b7e18bb6-1544-4904-aca4-27115f206673/iso-ts-23034-2021>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, 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
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms, definitions and abbreviated terms	1
3.1 Terms and definitions.....	1
3.2 Abbreviated terms.....	1
4 Method overview	2
4.1 General.....	2
4.2 Optical absorption of carbon nanomaterials.....	3
4.3 Optical absorption of biomolecules.....	4
4.4 Determination of the concentration of CNMs in dispersion by absorbance.....	4
4.5 Case studies.....	4
5 Materials and apparatus	5
5.1 Materials.....	5
5.1.1 Chemicals.....	5
5.1.2 Cell line.....	5
5.2 Apparatus.....	5
5.2.1 UV-Vis-NIR spectrometer.....	5
5.2.2 Cuvette for optical absorption measurement.....	5
5.2.3 Incubator, 37 °C, humidified, 5 % CO ₂ /air.....	5
5.2.4 Culture dishes, single-well or multi-well plates can be used. 6 multi-well plates with flat bottom are recommended.....	5
5.2.5 Centrifuge.....	5
5.2.6 Homogenizer.....	6
5.2.7 Cell counter.....	6
6 Cell-uptake testing protocol	6
6.1 General.....	6
6.2 Sample preparation.....	6
6.3 Preparation of calibration curve of CNM dispersions.....	6
6.4 Cell-seeding.....	6
6.5 Treatment of cells with testing suspension.....	7
6.6 Cell counting.....	7
6.7 Washing cells and preparation of the cell lysate.....	7
6.7.1 General.....	7
6.7.2 For adherent cells.....	7
6.7.3 For floating cells.....	8
6.8 Absorbance measurement of the cell lysate.....	8
7 Sources of variability	8
8 Data output	9
8.1 General.....	9
8.2 Data analysis and reporting.....	9
8.3 Data sheet format.....	9
Annex A (informative) Case study with SWCNTs	10
Annex B (informative) Case study of CNHs	16
Annex C (informative) Case study of MWCNTs	20
Bibliography	24

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).

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 229, *Nanotechnologies*.

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.

<https://standards.iteh.ai>
Document Preview
ISO/TS 23034:2021

<https://standards.iteh.ai/catalog/standards/iso/b7e18bb6-1544-4904-aca4-27115f206673/iso-ts-23034-2021>

Introduction

Owing to their unusual physical and chemical properties, carbon nanomaterials (CNMs), such as carbon nanotubes, carbon black, graphene, and carbon nanohorns, have been considered for various applications such as in the fields of electronics, energy, nanotechnology, and biology. With the increase of CNM-based products on the market, the public concern regarding possible toxicities has also increased. Estimation of the amount of CNM associated with the targeted cells is useful for an initial toxicological screening of CNMs and for developing applications in medicine^{[1][2][3][4]}.

Fluorescent dyes and/or radioactive isotopes have been routinely used to measure cellular uptake. Because CNMs absorb light in near infrared (NIR) region, where the bio-components such as protein and water in cells or tissues have relatively low light absorption, the cellular uptake of CNMs can be estimated from the absorbance of cell-lysate^{[5][6][7][8]}.

iTeh Standards (<https://standards.iteh.ai>) Document Preview

[ISO/TS 23034:2021](https://standards.iteh.ai/catalog/standards/iso/b7e18bb6-1544-4904-aca4-27115f206673/iso-ts-23034-2021)

<https://standards.iteh.ai/catalog/standards/iso/b7e18bb6-1544-4904-aca4-27115f206673/iso-ts-23034-2021>