
**Textiles and textile products —
Microplastics from textile sources —**

**Part 2:
Qualitative and quantitative analysis
of microplastics**

*Textiles et produits textiles — Microplastiques d'origines textiles —
Partie 2: Analyse qualitative et quantitative des microplastiques*



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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 document 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 38, *Textiles*.

A list of all parts in the ISO 4484 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.

Introduction

There is significant evidence that the textile sector releases microplastics (MPs) into the environment.

These particles, when present in the environment, can affect the biota, and so, their number, shape and size can be relevant parameters for the assessment of their potential impact and, consequently, the development of a counting technique can be a helpful approach.

Moreover, many of the microparticles analysed are not of synthetic origin and therefore it is necessary to identify and distinguish them from microplastics (MPs).

This document is designed to provide the nature, numerical concentration, surface area and (estimated) mass of the microplastics produced or released by the textile sector and collected in a solid, aqueous or aeriform matrices.

Depending on the matrix, pre-treatment of the sample is necessary to concentrate the microplastics and eliminate inorganic and organic (for example biological) components that can interfere with their identification. This document involves a preliminary observation of the sample by an optical microscope (OM) and then identification of the microplastics (MPs) by molecular spectroscopy. This document provides the possibility of using two different techniques of molecular spectroscopy, Micro-FTIR and Micro-Raman to identify and count plastic particles down to submicron size.

This document is designed to allow the re-evaluation of microplastic counting data when toxicological and environmental impact indications become available.

This document describes the method of analysis for a single filter. However, errors in the qualitative and quantitative determination of microplastics that can result from the variability between different filters imply that replicates should be performed to establish precision.

This document provides useful information (e.g. dimensional classes, shape, composition, etc.) that can be taken into account for a possible eco-toxicological assessment of health and environmental impacts. It is well known that some microplastics (MPs) are lipophile and can be vehicles for toxic compounds (e.g. PCBs, PAHs, dioxins) or vehicles of pathogenic microorganisms adhered to their surface and can be assimilated (with their dose of toxicity) and permeate into organisms and cells.

The sources of microplastics are numerous. Their shapes and sizes are also variable. In the case of those released by textiles, the typical (but not the only) morphology is fibrous and their diameter and length can vary depending on the construction parameters of yarns and fabrics or cleaning conditions.

Textiles and textile products — Microplastics from textile sources —

Part 2: Qualitative and quantitative analysis of microplastics

1 Scope

This document establishes a qualitative-quantitative analytical evaluation (i.e. determination) of microplastics to be able to define their:

- particle number;
- morphology (morphological characteristics);
- dimensional distribution;
- the type, chemical origin or nature of polymers and their colour, if present.

This document is applicable to the determination of microplastics (from the textile sector) collected in various matrices (for example textile process wastewater, clothes washing water, textile process air emissions, textile process solid waste).

This document specifies expression of results in terms of estimated surface area and mass of microplastics (MPs) per unit sample. It enables the expression of the results of the quantification of microplastics (MPs) from various sources, including samples related to the production, processing, treatment and use of textiles (raw material, manufacturing process, sample like wastewater from washing clothes, air, and industrial process water).

This document applies to textile sector samples of matrices of different physical states (solid, liquid or aeriform), for example:

- solid samples from textile production processes;
- water samples from the textile production process and/or from the washing of clothing (e.g. garments or other textiles, ISO 4484-1 or ISO 4484-3 can be applied in order to prepare a liquid to be tested);
- air samples to test the air quality in the workplace of textile companies.

This document, being able to provide information such as size, shape, surface and mass (estimated), enables the transfer of useful information for ecotoxicological assessments to specialists.

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 1833-4, *Textiles — Quantitative chemical analysis — Part 4: Mixtures of certain protein fibres with certain other fibres (method using hypochlorite)*

ISO 3696, *Water for analytical laboratory use — Specification and test methods*

EN 481, *Workplace atmospheres — Size fraction definitions for measurement of airborne particles*

EN 13284-1, *Stationary source emission — Determination of low range mass concentration of dust- Part 1: Manual gravimetric method*

EN 13284-2, *Stationary source emissions — Determination of low range mass concentration of dust — Part 2: Quality assurance of automated measuring systems*

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

microplastic **MP**

material consisting of a solid polymer containing particles, to which additives or other substances may have been added, and where a weight fraction of $\geq 1\%$ particles have:

- a) all sizes $100 \text{ nm} \leq x \leq 5 \text{ mm}$,
- b) for fibres, a length of $300 \text{ nm} \leq x \leq 15 \text{ mm}$ and a length/diameter ratio > 3

Note 1 to entry: Polymers that occur in nature that have not been chemically modified (other than by hydrolysis) are excluded, as are polymers that are (bio) degradable.

[SOURCE: ECHA, ANNEX XV Restriction Report - Microplastics, 22 August 2019, par 1.2.2.1, modified on lower size recommended dimensions, by Commission Recommendation C/2022/3689 of 10 June 2022 on the definition of nanomaterial (OJ C 229, 14.6.2022, p. 1), modified — " $\geq 1\% \text{ w/w}$ " was changed to "a weight fraction of $\geq 1\%$ "; additional information has been given as a note to entry.]

3.2

significant sample volume

amount of filtered volume to be analysed considering the source of the sample and the values of: total suspended solid (TSS) and chemical oxygen demand (COD)

Note 1 to entry: See [Table 1](#) and [Table 2](#).

3.3

subsample

aliquot (fraction) of the primary sample diluted (as known) with water

3.4

washing solution

solution used to wash equipment to recover any MP which can be left on the equipment

3.5

image analysis

identification and classification of particles/fibres according to their morphology (shape) and size, providing additional sample information.

Note 1 to entry: The sample information are, for example, distribution percentage, number and size of microparticles and microparticles with fibre shape.