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Molekularne diagnostične preiskave in vitro - Specifikacije za predpreiskovalne procese za cirkulirajoče tumorske celice (CTC) v venski polni krvi - 1. del: Izolirana RNK (ISO/DTS 7552-1:2024)

Molecular in vitro diagnostic examinations - Specifications for pre-examination processes for circulating tumour cells (CTCs) in venous whole blood - Part 1: Isolated RNA (ISO/DTS 7552-1:2024)

Spezifikationen für präanalytische Prozesse für zirkulierende Tumorzellen (CTC) in venösen Vollblutproben - Teil 1: Isolierte RNA (ISO/DTS 7552-1:2024)

Titre manque - Partie 1: Titre manque (ISO/DTS 7552-1:2024)

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Technical Specification

ISO/DTS 7552-1

Molecular in vitro diagnostic examinations — Specifications for pre-examination processes for circulating tumour cells (CTCs) in venous whole blood —

Part 1: Isolated RNA

ISO/TC 212

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Foreword

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Introduction

Solid tumours release cells and bioanalytes into blood and other body fluids. This has opened the option of utilizing such body fluids (liquid biopsies) for a minimally-invasive procedure for tumour detection, diagnosis and characterization. Liquid biopsies can enable earlier detection and diagnosis of cancers and advance personalized patient treatment.^[20,21]

These applications have become one of the fastest growing segments of the entire diagnostic market.

Circulating tumour cells (CTCs) in venous whole blood can reflect the disease complexity that evolves during tumour progression, with distinct genetic, epigenetic and gene expression biomarkers.^[41]

Besides the prognostic role of CTC identification and enumeration in cancer progression, CTC molecular characterization can improve disease outcome prediction, therapeutic guidance and post-treatment monitoring of the patient.^[39]

CTCs are now considered as a surrogate of tumour tissue in cancer early development, progression and metastatic phase^[23].

Molecular characterization of CTCs can provide a strategy for monitoring cancer genotypes during systemic therapies,^[24] identifying mechanisms of disease progression, identifying novel targets for biological treatment^[25] and selecting targeted therapies^[39].

Moreover, CTC single-cell sequencing is emerging as an important tool for tumour genomic heterogeneity analysis.^[26-28] CTCs are fragile and tend to degrade within a few hours when collected in conventional blood collection tubes, e.g. EDTA containing tubes, without dedicated CTC stabilizers. CTCs are extremely rare, especially in early disease, e.g. less than 10 cells per 10 ml of blood, representing a ratio of approximately 1:10⁷ CTCs to white blood cells (WBCs). This low ratio represents a significant challenge to CTC enrichment required for examination.

RNA profiles of CTCs resemble gene expression profiles of tumours. For RNA profile analysis, measures to remove the WBCs are necessary in order to obtain sufficiently enriched CTC-specific RNA.

RNA profiles can change significantly after blood collection, during CTC enrichment and isolation. Therefore, special measures are necessary to obtain CTC samples of adequate quality and isolated RNA of appropriate quality for ensuring the specified RNA examination performance.^[29]

Standardization includes all steps of the pre-examination process, including blood collection and stabilization, transport, storage, CTC enrichment, CTC isolation (if included), and RNA isolation. This pre-examination standardization is crucial to ensure reliable examination results in current clinical use and is also critical to develop new CTC based diagnostic examinations and to establish these in clinical healthcare.^[30]

An illustration of critical steps of the CTC pre-analytical workflow is provided in [Annex A](#).

This document describes special measures to obtain appropriate quality and quantity of RNA from CTC-containing blood specimens for subsequent examination.

Molecular *in vitro* diagnostic examinations — Specifications for pre-examination processes for circulating tumour cells (CTCs) in venous whole blood —

Part 1: Isolated RNA

1 Scope

This document specifies requirements and gives recommendations on the handling, storage, CTC enrichment and isolation, RNA isolation and storage, and documentation of venous whole blood specimens intended for the examination of RNA isolated from circulating tumour cells (CTCs) during the pre-examination phase before a molecular examination is performed.

This document is applicable to molecular *in vitro* diagnostic examinations including laboratory-developed tests performed by medical laboratories. It is also intended to be used by laboratory customers, *in vitro* diagnostics developers and manufacturers, biobanks, institutions, and commercial organizations performing biomedical research, and regulatory authorities.

This document does not cover the isolation of cellular RNA directly from venous whole blood containing CTCs. This is covered in ISO 20186-1.

This document does not cover the isolation of specific white blood cells and subsequent isolation of cellular RNA therefrom. This document does not cover pre-analytical workflow requirements for viable CTC cryopreservation and culturing.

NOTE 1 The requirements given in this document can also be applied to other circulating rare cells (e.g. foetal cells).

NOTE 2 International, national or regional regulations or requirements can also apply to specific topics covered in this document.

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 15189, *Medical laboratories — Requirements for quality and competence*

ISO 15190, *Medical laboratories — Requirements for safety*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15189 and the following 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/>

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3.1

aliquot

portion of a larger amount of homogenous material, assumed to be taken with negligible sampling error

Note 1 to entry: The term is usually applied to fluids. Tissues are heterogeneous and therefore cannot be aliquoted.

[SOURCE: ISO 20166-3:2018, 3.1]

3.2

analyte

component represented in the name of a measurable quantity

[SOURCE: ISO 17511:2020, 3.1, modified — the example has been removed.]

3.3

backflow

flow of a liquid opposite to the usual or desired direction

3.4

blood collection set

intravenous device specialized for venipuncture consisting of a stainless steel beveled needle and tube (tubing) with attached plastic wings and fitting connector

Note 1 to entry: The connector attaches to an additional blood collection device, e.g. a *blood collection tube* (3.5).

3.5

blood collection tube

tube used for blood collection, usually in a vacuum which forces blood from the vein through the needle and into the tube

3.6

circulating tumor cells

CTCs

cells present in blood, originating from a primary or metastatic site(s) of a tumor

3.7

closed system

non-modifiable system provided by the vendor including all necessary components for the analysis (i.e. hardware, software, procedures and reagents)

[SOURCE: ISO 20186-2:2019, 3.6]

3.8

CTC enrichment

method that is able to increase the ratio of *CTCs* (3.6) to other cells including white blood cells in a *sample* (3.24)

3.9

CTC isolation

method resulting in a *sample* (3.24) containing *CTCs* (3.6) without any other cell type

3.10

deoxyribonuclease

DNase

enzyme that catalyzes the degradation of DNA into smaller components

[SOURCE: ISO 20186-1:2019, 3.11]