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Nanotechnologies - Size distribution and concentration measurement of inorganic nanoparticles in aqueous media - Single particle inductively coupled plasma mass spectrometry

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1.Structure and Drafting Rules of Standardization Documents"

Drafting.

This document is equivalent to ISO /T S19590.2017 "Nanotechnology Single Particle Inductively Coupled Plasma Mass Spectrometry for Measurement of Water Phase

"Size Distribution and Concentration of Inorganic Nanoparticles", the file type was adjusted from ISO 's technical specifications to my country's national standards.

This document has made the following minimal editorial changes.

---In order to coordinate with the existing standards, the name of the standard is changed to "Measurement Sheet for Size Distribution and Concentration of Inorganic Nanoparticles in Nanotechnology Aqueous Phase"

Particle inductively coupled plasma mass spectrometry.

Please note that some content in this document may be subject to patents. The publisher of this document assumes no responsibility for identifying patents.

Introduction

This document has been developed to address the need for methods for the detection and characterization of nanoparticles in food and consumer products. Because nanotechnology may contain engineered sodium

Rice grain products have been widely used and have begun to affect relevant industries and markets, so consumers may be exposed directly and indirectly (except for natural

(other than natural nanoparticles) engineered nanoparticles. Detection of engineered nanoparticles in food, toxicology and exposure study samples becomes Nanoparticle

Apply an essential part of the assessment of potential benefits and potential risks.

Single particle inductively coupled plasma mass spectrometry (spICP-MS) is a method capable of detecting single nanoparticles at very low concentrations.

method. A conventional ICP-MS system is set up to acquire data in high temporal resolution mode (i.e., short dwell time). Mass spectrometers can

It is set to measure any element, but due to high time resolution, current instruments usually only detect one mass-to-charge ratio (m/

z) value. The aqueous sample continuously enters the ICP-MS. After atomization, a part of the nanoparticles enter the plasma and are atomized and ionized. each

The atomized particles create an ion cluster, which is collected by a mass spectrometer. Since the ion density in the ion cluster is very high, the pulse signal generated by it

signal is much higher than the background (or baseline) signal.

The number of detected pulses per unit time is proportional to the number of nanoparticles in the aqueous suspension to be measured. When calculating concentration, use nanoparticles

particle standard sample to determine transfer efficiency. Pulse intensity, pulse area and the mass of the measured element in the nanoparticle, that is, the cube of the nanoparticle diameter

Proportional (assuming the nanoparticle geometry is spherical). As the diameter of the nanoparticle increases, the signal response value will increase cubically, so

The response needs to be verified for each composition and each size range of nanoparticles. It is best to use nanoparticle standard samples for calibration, which cannot be obtained

When obtaining such a standard sample, perform calibration in this step using the ion standard solution of the element being measured under the same sample analysis conditions.

The data can be processed using commercially available software or imported into a

custom spreadsheet program to calculate the number, mass concentration, size, and size of nanoparticles.

inches (equivalent spherical diameter) and the corresponding number-average size distribution. Furthermore, using this data, the mass concentration of ions present in the sample can be determined simultaneously.

Interested readers can consult references [8]~[11] for more information.

Nanotechnology of inorganic nanoparticles in aqueous phase

Size distribution and concentration measurements

Single particle inductively coupled plasma mass spectrometry

1 Scope

This document describes the mass determination of single nanoparticles using inductively coupled plasma mass spectrometry (ICP-MS) in time-resolved mode.

quantity and ion concentration in the suspension, detect nanoparticles in the aqueous suspension, and characterize the number and mass concentration of particles, particle size and number average

size distribution method.

This document applies to inorganic nanoparticles [such as gold (Au), silver (Ag), titanium dioxide (TiO2), bismuth vanadate (BiVO4) in aqueous suspensions

etc. metals and metal oxides] size determination. This document also applies to metal compounds other than oxides whose chemical composition and density are known (such as sulfur

Chemical compounds, etc.), metal composites or coated particles with metal cores. This document determines the size of nanoparticles in aqueous suspensions.

The size range is 10nm~100nm (measurable particles are larger, up to 1000nm~2000nm), and the particle number concentration range is 106/L~

109 pieces/L, the corresponding mass concentration range (for 60nm gold nanoparticles) is about 1ng/L~1000ng/L. actual measured number

The amount depends on the type of mass spectrometer used and the type of nanoparticles analyzed.

In addition to particle concentration, this document also applies to the determination of ion concentration in suspensions. The ion concentration detection limit is similar to that of conventional ICP-MS.

when. It should be noted that nanoparticles with a size smaller than the particle size

detection limit of single particle inductively coupled plasma mass spectrometry (spICP-MS)

May be quantified as ions.

This document does not apply to the detection and characterization of organic or carbon-based nanoparticles such as encapsulation materials, fullerenes and carbon nanotubes (CNTs), nor does it

Suitable for elements other than carbon that are difficult to measure by ICP-MS. Reference [12] provides an overview of the elements that spICP-MS can detect and the

Minimum particle size.

2 Normative reference documents

The contents of the following documents constitute essential provisions of this document through normative references in the text. Among them, the dated quotations

For undated referenced documents, only the version corresponding to that date applies to this document; for undated referenced documents, the latest version (including all amendments) applies to

this document.

ISO /T S80004-1 Nanotechnologies-Vocabulary-Part 1.Core terms (Nanotechnologies-Vocabulary-Part 1.

Coreterms)

Note. GB/T 30544.1-2014 Nanotechnology terminology Part 1.Core terms (ISO /T S80004-1.2010, IDT)

3 Terms and definitions

The terms and definitions defined in ISO /T S80004-1 and the following apply to this document.

The standardized terminology databases of ISO and IEC can be found at.

3.1

nanoparticles nanoparticles

Nanoobjects with external dimensions in the nanometer scale in all three dimensions.