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**Nanotechnologies - Measurement method for the
peroxidase-like activity of iron oxide nanoparticles**

纳米技术 氧化铁纳米颗粒类过氧化物酶活性测量方法

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Foreword

This standard was drafted in accordance with the rules given in GB/T 1.1-2009. This standard was proposed by the Chinese Academy of Sciences. This standard is under the jurisdiction of the National Nanotechnology Standardization Technical Committee (SAC/TC279). This standard was drafted. Southeast University, Institute of Biophysics, Chinese Academy of Sciences, Nanjing Dongna Biotechnology Co., Ltd., Chinese Medical Sciences Institute of Basic Medical Sciences, Jiangsu Institute of Metrology, Basic Egg Biotechnology Co., Ltd., Second Affiliated Hospital of Nanjing Medical University Hospital Laboratory Medicine Center. The main drafters of this standard. Zhang Yu, Gu Ning, Yan Xiyun, Xu Haiyan, Huang Yixin, Dong Haijun, Wen Tao, Ji Yongxin, Dong Jinlai, Sun Ying, Gu Jiayu, Wang Luhai, Zhu Yefei.

Iron oxide nanoparticles have a wide range of applications in biomedical fields due to their rich magnetic properties and good biocompatibility. Including magnetic separation and biosensing, magnetic resonance imaging, magnetic induction hyperthermia, magnetic nanomedicine, etc., also found to have peroxidase-like activity and catalase activity, which not only expands the application of magnetic nanomaterials, but also expands the study of mimic enzymes from organic complexes to inorganic nanomaterials. At present, a large number of basic research and applied research have been reported, more than 40 kinds of nanoparticles, including ferroferric oxide (Fe_3O_4), γ -ferric oxide ($\gamma\text{-Fe}_2\text{O}_3$), cobalt trioxide (Co_3O_4), copper oxide (Cu_2O), manganese ferrite (MnFe_2O_4), iron sulfide (FeS), oxygen Cesium (CeO_2), Prussian blue (PB), gold (Au), platinum (Pt), graphene, fullerenes, carbon nanotubes, etc., were found to have peroxidase-like Activity and other mimic enzyme activities, especially Fe, Co, Cu, Mn and other Fenton elemental compound nanoparticles with variable price Type, and applications in many fields such as biology, medicine, environment, agriculture, etc. Nanoparticle mimetic enzymes are simple and easy to obtain relative to natural enzymes. Stable, low cost, and has an enzyme-like

activity that is dependent on size and surface. It also has other multifunctional functions such as magnetism and optics. Sex, therefore more research significance and a wide range of application values. Nanoparticle peroxidase activity refers to the number of enzyme activity units per unit mass or volume of sample. Due to the activity of nanoparticle enzymes Landing depends on its variety, size, surface, crystal structure and other factors, so its measurement and evaluation of catalytic activity is more complicated. This leads to the purpose The nanoparticle enzyme activity data reported in previous studies is difficult to compare, even if the same kind of nanoparticles have poor physical and chemical properties such as size and surface. Differences and different test conditions can result in incomparable data. Therefore, the establishment of a nanoparticle enzyme activity measurement and evaluation The standard method is crucial. This standard provides for the development of related testing and medical diagnostic reagents, as well as the evaluation of the activity of nanomaterials in the fields of environment and agriculture. reference. Nanotechnology iron oxide nanoparticle peroxide Enzyme activity measurement method

1 Scope

China's national method for measuring the peroxidase-like activity of iron oxide nanoparticles. It specifies the terms and definitions, the abbreviations, the principle, the instruments and reagents, and the preparation of solutions. The subject is one of the more interesting findings in nanoscience: iron oxide nanoparticles, which had been used for years as magnetic labels and contrast agents on the assumption that they were inert, turn out to catalyse the same reaction as the enzyme horseradish peroxidase. They are, in effect, an artificial enzyme - a nanozyme - and unlike a real enzyme they are cheap, stable, and unaffected by heat or pH extremes. That has made them a substitute for peroxidase in immunoassays and biosensors. It also means that any particle used in a biological setting has a catalytic activity that must be accounted for rather than assumed absent. Measuring it consistently is what this method provides.

This standard specifies the measurement method for the activity of iron oxide nanoparticle peroxidase. This standard applies to the use of spectrophotometer for iron oxide (such as ferric oxide, ferroferric oxide, etc.) nanoparticle peroxidase activity Sexual measurement and evaluation. The measurement of peroxidase activity of other nanoparticles can also be referred to.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only dated versions apply to this article. Pieces. For undated references, the latest edition (including all amendments) applies to this document.

GB/T 19267.2 Physical and chemical testing of trace minerals - Part 2. UV-Vis absorption spectroscopy JJG178 UV, visible, near-infrared spectrophotometer verification procedures 3

terms and definitions, abbreviations

3.1 Terms and definitions The following terms and definitions apply to this document.

3.1.1 Nanoparticles The external dimensions of the three dimensions are all nanoscale objects at the nanometer scale. [

GB/T 32269-2015, definition 4.1]

3.1.2 Enzyme activity enzyme activity The ability of an enzyme to catalyze a chemical reaction.

Note 1. The size of the enzyme activity can be expressed by the reaction rate of a certain chemical reaction catalyzed by a certain condition.

Note 2. The iron oxide nanoparticle peroxidase activity in this standard refers to the enzyme activity unit contained in the iron oxide nanoparticles corresponding to the mass of the Fe element. The number is in U·mg⁻¹.

Note 3. Enzyme activity unit. The International Biochemistry Association Enzyme Commission recommends the use of international units, ie one micromolar (μmol) per minute under specified conditions. The amount of substrate enzyme is an International Unit (IU), abbreviated as U. 1U = 1 μmol·min⁻¹.

3.2 Abbreviations The following abbreviations apply to this document. DMSO.

Dimethylsulfoxide H₂O₂. Hydrogen peroxide (Hydrogenperoxide) NPs. Nanoparticles SOP. Standard Operating Method (StandardOperationProcedure) TMB.

3,3',5,5'-tetramethylbenzidine (3,3',5,5'-Tetramethylbenzidine)