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An Immunosandwich Colorimetric Method for the Visual Detection of Glycoproteins Based on Janus Nanozymes

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Abstract

Glycoproteins are trustworthy biomarkers for detecting cancer in its earliest stages, and prompt treatment in response to these biomarkers may increase survival rates and ease the strain on healthcare systems. Conventional detection methods, such as immune-based assays, on the other hand, frequently require natural antibodies, intricate sample preparations, and lengthy processing durations, which fall short of offering quick turnaround times. In an effort to solve this issue, a Janus gold nanoparticles nanozyme (J-GNPsNE) linked magnetic titanium dioxide molecularly imprinted particles (MTi-MIP) satellite structure immunosandwich colorimetric strategy (SS-ICS) is suggested to for the first time rapidly detect glycoproteins in human serum. The assembly of molecularly imprinted nanoparticles, glycoprotein, and nanozyme in the shape of a sandwich is what gives the method its distinctive detection mode. This made it possible to develop a point-of-care serum glycoprotein biomarkers detection instrument that was labor-saving, simple to use.

Keywords: Glycoproteins; Biomarkers; Nanozyme; Immunosandwich

Introduction

Biochemical and pathological processes such cell signalling, virus pathogenesis, and cancer cell metastasis are known to be significantly regulated by glycoproteins. They are very important as biomarkers and therapeutic targets because they can provide data on the physiological condition of the cells, which is useful for clinical diagnosis and outcome assessment [1]. However, glycoproteins are often present in low abundance and cohabit with numerous other comparable molecules that are present in high abundance in the human body. Numerous techniques, such as mass spectrometry, affinity chromatography, fluorescence, and enzyme-linked immunosorbent assay (ELISA), have been developed to date for the identification and quantification of glycoproteins. With the benefit of high specificity, ELISA is the method of choice for quantitative protein detection in clinical settings.

ELISA has developed quickly thanks in part to clinical applications, but there are still several issues that must be methodically and thoroughly addressed in order for the technology to be used in practise. It is crucial to use primary antibodies, whether they are synthetic or natural. It is necessary to use enzymes to label the principal antibodies in the test, but not every antibody can be labelled and the process is expensive. Second, the detection procedure is time-consuming and laborious, regardless of whether it is carried out manually or with the use of specialised tools [2, 3]. Thirdly, in order to use expensive precision instruments like fluorescence and Raman spectroscopy et al which are challenging to use in resource-limited areas, the mainstream high sensitivity signal readout pattern also has to rely on expensive instruments. As a result, creating a fresh alternative plan.

Design and preparation of materials in SS-ICS

Supporting information contains specifics about the instruments, reagents, and other experimental steps used to investigate performance. "Specific recognition unit" and "signal output unit" are the two key components of an ELISA-like detection method, respectively [4]. An artificial particular recognition unit MTi-MIP was initially created in order to address the issues with antibody-assisted recognition. In Fig. 1A, the MTi-MIP synthesis processes are depicted. In a nutshell, the TiO2 shell was uniformly wrapped around the surface of the well-dispersed Fe3O4 created by the solvothermal process (Fe3O4@TiO2). An equally essential and significant component of ELISA-like immunosandwich detection methods is the specific recognition unit, in addition to the signal output unit. The use of molecular imprinting technology as a potential artificial intelligence method to address the limitations of antibody-assisted recognition [5, 6,7].

As a result, we suggested a novel SS-ICS for the quick visual analysis of glycoproteins in the current paper. Two engineered materials, the asymmetrically modified J-GNPsNE and the boric acid affinity-oriented MTi-MIP, were present in the SS-ICS. In order to create MTi-MIP, magnetic nanoparticles' surfaces are first coated with titanium dioxide in the shape of flowers in order to increase their specific surface area. After that, the surfaces are modified with a boric acid affinity group, and the MIP layer is created using a silica surface imprinted technique (Fig. 1A). When preparing J-GNPsNE, the GNPs were competitively modified with 4-mercaptophenylboronic acid and poly-(acrylic acid), which can function as a target recognition and signal amplification unit, to produce J-GNPsNE (Fig. 1B). The J-GNPsNE can act as a target recognition and signal amplification unit. The MTi-MIP can be used as a "artificial antibody" to specifically recognise glycoproteins in complex [8, 9].

Conclusion

In conclusion, we developed an easy-to-use SS-ICS for the visual detection of disease-associated glycoproteins. The J-GNPsNE was created by the asymmetrically modified gold nanozyme to function as a signal amplification and readout unit, whilst the MTi-MIP was designed by the boric acid affinity surface imprinting layer with a

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TiO2 enclosed magnetic core as a specific recognition unit. The SS-ICS enables low-cost, amateur manipulation that is also not dependent on nature [10].

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Potential Conflicts of Interest

The authors affirm that they have no known financial or interpersonal conflicts that might have appeared to have an impact on the research presented in this paper.

References

1. Wei H, Wang EK (2013) Nanomaterials with enzyme-like characteristics (nanozymes): Next-generation artificial enzymes. Chem Soc Rev 42: 6060-6093.
2. Gao LZ, Zhuang J, Nie L, Zhang JB, Zhang Y, et al.(2007) Intrinsic peroxidase-like activity of ferromagnetic nanoparticles. Nat Nanotechnol 2: 577-583.
3. Perez JM (2007) Iron oxide nanoparticles Hidden talent. Nat Nanotechnol 2: 535-536.
4. Comotti M, Pina CD, Matarrese R, Rossi M (2004) The Catalytic Activity of “Naked” Gold Particles Angew. Chem Int Ed 43: 5812-5815.
5. Pirmohamed T, Dowding JM, Singh S, Wasserman B, Heckert E (2010) Nanoceria exhibit redox state-dependent catalase mimetic activity. Chem Commun 46: 2736-2738.
6. Mu JS, Wang Y, Zhao M, Zhang L(2012) Intrinsic peroxidase-like activity and catalase-like activity of Co3O4 nanoparticles. Chem Commun 48: 2540-2542.
7. Yin JF, Cao HQ, Lu YX (2012) Self-assembly into magnetic Co3O4 complex nanostructures as peroxidase. J Mater Chem22: 527-534.
8. Chen W, Chen J, Feng YB, Hong L, Chen QY, et al. (2012) Peroxidase-like activity of water-soluble cupric oxide nanoparticles and its analytical application for detection of hydrogen peroxide and glucose. Analyst 137: 1706-1712.
9. Wan Y, Qi P, Zhang , Wu JJ, Wang Y(2012) Manganese oxide nanowire-mediated enzyme-linked immunosorbent assay. Biosens Bioelectron 33: 69-74.
10. André R, Natálio F, Humanes M, Leppin J, Heinze K, et al. (2011) V2O5 Nanowires with an Intrinsic Peroxidase-Like Activity. Adv Funct Mater 21: 501-509.