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Features of gold nanoparticles application for bio- and nanosensors

Abstract

The paper presents short review of the features of gold nanoparticles application for various biosensors and nanosensors. The main specific properties of gold nanoparticles which determine their use in the development of different types of biosensors and nanosensors are discussed in brief.

Keywords: gold nanoparticles, biosensors, nanosensors, detection

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Abbreviations: AuNP, gold nanoparticles; LSPR, localized surface plasmon resonance; SERS, surface enhanced Raman scattering

Introduction

Due to the complex of unique chemical, physical and biological properties nanomaterials are actively used today in technologies of various sensors development.[1–3] The application of nanomaterials gives opportunity to provide revolutionary changes in sensitivity, specificity and rapidity of detection as well multiplexing capability, simple operation, miniaturization and low cost of such devices. Among nanostructures fullerenes, single walled and multiwalled carbon nanotubes, magnetic nanoparticles, modified silicon nanowires, dendrimers, quantum dots and others have found their use in the practice of bio-and nanosensors development, but only gold nanoparticles (AuNP) can be marked as the most used and widespread.[4–7]

Discussion

Besides the common properties typical for nanomaterials, the main specific characteristics of gold nanostructures such as quite simple methods for controlled synthesis of particles with certain size and shape (including spherical nanoparticles, nanorods, nawires, nanoshells, nanodisks, nanocubes, nanotriangles, nanooctahedrons etc.), stability for a long period of time, easy surface functionalization, biocompatibility, unique optical properties and high catalytic activity provide the successful use of gold nanoparticles in the development of various bio-and nanosensors.[7–11] The specific characteristics mentioned above determine the main features of AuNP use in the development of different types of biosensors and nanosensors for detection of various samples including inorganic and organic pollutants,[4,12–14] toxins,[15,16] pathogens,[5,17] biomolecules,[6,18–20] enzyme activity,[10,21] as well as diagnostics of different diseases,[22,23] etc. Thus, unique size-dependent optical properties of AuNP in combination with capabilities to surface functionalization define their effective use in the development of various LSPR-based, SERS-based and colorimetric nano- and biosensors.[24,25] The use of gold nanoparticles in such sensors gives opportunity to amplify the signal and as result to enhance sensitivity of the device. The possibility of easy immobilization of antibodies on the nanoparticles surface determines the AuNP effective use in the development of nanoimmunosensors.[26] Due to the own specific features AuNP are also found their effective application like ink in the inkjet-printing technologies under the development of novel class of miniature, high sensitive and cost-effective sensors.[27]

Conclusion

Therefore, in compare with other nanomaterials AuNP due to the combination of unique features occupy the leading position in their usefulness for development of new biosensors and nanosensors with high sensitivity, specificity, rapidity of detection and other key necessary properties.

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Conflict of interest

None.

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