2023年第34期总409期

农牧业信息化专题

本期导读

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相关专利

1. 用于测量土壤中离子浓度的印刷电位传感器

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学术文献

1．Development of silver nanoparticles and aptamer conjugated biosensor for rapid detection of *E. coli* in a water sample（用于水样中大肠杆菌快速检测的纳米银和适配体共轭生物传感器的研制）

简介：A simple, rapid, and sensitive electrochemical biosensor based on a screen-printed carbon electrode (SPCE) was developed for onsite detection of *E. coli* in real time. This work analyzed the effect of aptamer conjugation and PBS buffer solution on the colloidal stability of the silver nanoparticles (AgNPs). Aggregations of the AgNPs after aptamer conjugation in PBS buffer were observed from the particle size distribution analysis. The AgNP-aptamer conjugation and its affinity towards *E. coli* (DH5α) were confirmed by UV-visible spectrophotometry, which showed a linear increment in the absorption with increasing *E.coli* concentration. The screen-printed carbon electrodes were modified by drop-casting of AgNPs, which were used as an effective immobilization platform for *E. coli*-specific aptamers. The modified electrode's surface modification and redox behavior were characterized using cyclic voltammetry. Finally, *E. coli* was detected using differential pulse voltammetry with an optimized incubation time of 15 min. The developed biosensors showed a linear decrease in current intensity with an increase in the concentration of *E. coli*. The biosensor had a relative standard deviation (RSD) of 6.91% (n=3), which showed good reproducibility. The developed biosensors are highly sensitive and have a limit of detection (LOD) as low as 150 CFU/ml. The biosensor showed good selectivity for *E.coli* coli when comparing the signal response obtained for bacteria other than *E.coli*. Also, the biosensor was found stable for four weeks at room temperature and showed high recoveries from 95.27% to 107% during the tap water sensitivity validation.

来源：3 BIOTECH

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2．An Ultrasensitive Voltammetric Genosensor for the Detection of Bacteria *Vibrio cholerae* in Vegetable and Environmental Water Samples（一种用于检测蔬菜和环境水样中霍乱弧菌的超灵敏伏安基因传感器）

简介：In view of the presence of pathogenic *Vibrio cholerae* (*V. cholerae*) bacteria in environmental waters, including drinking water, which may pose a potential health risk to humans, an ultrasensitive electrochemical DNA biosensor for rapid detection of *V. cholerae* DNA in the environmental sample was developed. Silica nanospheres were functionalized with 3-aminopropyltriethoxysilane (APTS) for effective immobilization of the capture probe, and gold nanoparticles were used for acceleration of electron transfer to the electrode surface. The aminated capture probe was immobilized onto the Si-Au nanocomposite-modified carbon screen printed electrode (Si-Au-SPE) via an imine covalent

bond with glutaraldehyde (GA), which served as the bifunctional cross-linking agent. The targeted DNA sequence of *V. cholerae* was monitored via a sandwich DNA hybridization strategy with a pair of DNA probes, which included the capture probe and reporter probe that flanked the complementary DNA (cDNA), and evaluated by differential pulse voltammetry (DPV) in the presence of an anthraquninone redox label. Under optimum sandwich hybridization conditions, the voltammetric genosensor could detect the targeted *V. cholerae* gene from 1.0 x 10(-17)-1.0 x 10(-7) M cDNA with a limit of detection (LOD) of 1.25 x 10(-18) M (i.e., 1.1513 x 10(-13) μg/μL) and long-term stability of the DNA biosensor up to 55 days. The electrochemical DNA biosensor was capable of giving a reproducible DPV signal with a relative standard deviation (RSD) of <5.0% (*n* = 5). Satisfactory recoveries of *V. cholerae* cDNA concentration from different bacterial strains, river water, and cabbage samples were obtained between 96.5% and 101.6% with the proposed DNA sandwich biosensing procedure. The *V. cholerae* DNA concentrations determined by the sandwich-type electrochemical genosensor in the environmental samples were correlated to the number of bacterial colonies obtained from standard microbiological procedures (bacterial colony count reference method).

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3．Scopes and challenges of microfluidic technology for nanoparticle synthesis, photocatalysis and sensor applications: A comprehensive review(微流控技术在纳米颗粒合成、光催化和传感器应用中的范围和挑战：综述)

简介：Microfluidic technology offers a plethora of completely unique and novel pathways for the preparation of various nanostructured materials. It enables rapid synthesis of nanoparticles with greater control over their shape and size compared to the batch chemical reactors. Synthesis in miniaturized microfluidic reactors is highly cost-effective as the requirement of chemicals and reagents is considerably reduced. Microfluidic reactors are also being increasingly used in photocatalytic investigations in recent years owing to their superiority over the conventional photocatalytic reactors. Thus, considering the growing importance of this relatively new technology, this article presents an overview of the recent developments in the area of microreactor-based synthesis of various nanostructured materials, such as quantum dots, core-shell nanoparticles, metal-based nanoparticles, and nanocomposites. This review also discusses the latest advancements in the field of microreactor-based photocatalytic decontamination of water using nanomaterials. Since microfluidics is also evolving as a promising platform for sensing applications, here, some of the interesting reports on nanomaterial-based microfluidic sensors have also been discussed. In conclusion, the pros and cons of using this emerging technology in nanomaterial synthesis, photocatalysis and sensing have been briefly reviewed.

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4．Recent advances in microfluidic devices for foodborne pathogens detection(用于食源性病原体检测的微流体装置的最新进展)

简介：Rapid and accurate detection of foodborne pathogens is a powerful and effective strategy to prevent the outbreak of foodborne diseases. Conventional detection methods like the plate counting and molecular diagnosis strategies are still not suitable for timely and rapid on-site detection due to the cumbersome operations, requirement of trained operators and sophisticated instruments. Microfluidics provide a powerful tool for pathogen detection due to the intrinsic advantages including easy integration, miniaturization, portability, and small sample consumption. Up to now, many research works have reported the combination of microfluidics with various detection techniques and signal amplification technologies to achieve the rapid and sensitive detection of foodborne pathogens. In this review, we mainly summarized the significant developed microfluidic based devices for pathogenic bacteria detection over the past five years, including (1) integration of sample preparation techniques like cell capture and enrichment, and nucleic acid related sample preparation methods on chip; (2) various detection methods, such as colorimetric, fluorescence, chemiluminescence, and mass spectrometry; (3) microfluidic paper-based analytical devices, particularly for the applications in resource-limited settings, remote areas or on-site detection. The limitations and advantages of these methods were summarized and discussed in order to comprehensively understand the latest microfluidic-based detection techniques for foodborne pathogens. Finally, the future challenges and directions for pathogens detection based on microfluidic based biosensors were also discussed and summarized.
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5．Simultaneous detection of foodborne pathogenic bacteria in milk by fluorescence immunoassay(荧光免疫法同时检测牛奶中食源性致病菌)

简介：Rapid, sensitive and simultaneous detection of multiple bacteria in foodborne is still a major challenge in public health field. Here, a fluorescence immunoassay that can achieve high-throughput detection of three Gram-positive foodborne pathogenic bacteria simultaneously was proposed. Vancomycin and bovine serum albumin conjugate (Van-BSA) was immobilized on a polycarbonate chip to capture three Gram-positive foodborne pathogenic bacteria, *Staphylococcus aureus* (*S. aureus*), *Bacillus cereus* (*B. cereus*) and *Listeria monocytogenes* (*L. monocytogenes*). CdSe/ZnS quantum dot modified antibodies

(Ab-QD) were prepared by carbodiimide coupling chemistry. Due to the affinity reaction between antibodies and proteins on the bacterial surface, the simultaneous detection of multiple Gram-positive bacteria was achieved by monitoring the fluorescence signal of quantum dot by a portable microfluidic chip analyzer. Under optimal conditions, low detection limits was 18 CFU/well, 3 CFU/well and 36 CFU/well for *S. aureus*, *B. cereus* and *L. monocytogenes*, respectively. With satisfactory accuracy and precision, the proposed fluorescence immunoassay holds good prospects to detect pathogens in real food samples.

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相关专利

1．Printed potentiometric sensors to measure ion concentration in soil(用于测量土壤中离子浓度的印刷电位传感器)

简介：公开了一种示例装置。该装置包括参比电极和离子选择电极(ISE)。所述参比电极包括参比电极衬底、通过在所述参比电极衬底上的可打印组合物形成的参比电极导体、以及在所述碳纳米管层上形成的参比膜。ISE包括ISE基板，通过在ISE基板上的可打印组合物印刷在基板上的ISE导体，以及通过可打印膜溶液印刷在导体上的离子选择膜。

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