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Revolutionizing Agriculture and Food Safety: MXene-Powered Nucleic Acid Biosensors

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Introduction

Agriculture and food systems play a critical role in sustaining global populations and ensuring food security. However, the ever-increasing demand for safe and nutritious food necessitates continuous advancements in monitoring and detection technologies. One promising area of innovation lies in the development of MXene-powered nucleic acid biosensors, which have the potential to revolutionize agriculture and food safety practices [1]. MXenes, a class of two-dimensional materials, offer exceptional conductivity, biocompatibility, and unique surface properties, making them ideal candidates for enhancing the sensitivity and efficiency of biosensors. This article explores the significant impact of MXene-based nucleic acid biosensors on agricultural and food systems, highlighting their potential applications and benefits. In the quest for ensuring sustainable and safe agricultural practices and maintaining food security, the integration of advanced technologies has become paramount. Among these technologies, MXene-based nucleic acid biosensors have emerged as a revolutionary solution for enhancing the detection and monitoring capabilities in agricultural and food systems. By harnessing the unique properties of MXene nanomaterials and leveraging the specificity of nucleic acid interactions, these biosensors offer immense potential in revolutionizing the field of agriculture and food safety [2].

Description

single-strand DNA (ssDNA) or RNA macromolecules normally hybridize with their integral strands to frame twofold abandoned atoms with high soundness. As a result, NA-based bioprobes are frequently utilized as biorecognition components in various biosensors. DNA microarray, gene lab-on-a-chip technology, and the PCR amplification process all benefit from the hybridization performance in the development of genoanalytical devices for NA analysis and monitoring. When those specific fragments were isolated from large libraries incorporated with the Systematic Evolution of Ligands by the Exponential Enrichment (SELEX) method, the significant evolution of NA fragments on high affinity and specificity to non-NAs continued. Applications for NA-based biosensors, also known as aptasensors, have increased as a result of these NA fragments or aptamers, NAs have also been shown to act as a catalyst. In biosensing systems, DNAzymes, RNAzymes, aptazymes, and ribozymes now play important roles [3].

MXene-powered nucleic acid biosensors hold immense potential in improving agriculture and food safety practices. These biosensors leverage the outstanding properties of MXenes, such as high electrical conductivity, large surface area, and excellent biocompatibility, to detect and analyze nucleic acids, including DNA and RNA, with exceptional sensitivity and specificity. By harnessing the unique characteristics of MXenes, these biosensors enable rapid and accurate detection of various pathogens, contaminants, and genetically modified organisms in agricultural and food samples. The integration of MXenes into nucleic acid biosensors offers several advantages. Firstly, the high electrical conductivity of MXenes facilitates efficient electron transfer, resulting in enhanced signal transduction and improved detection sensitivity. This enables the biosensors to detect even low concentrations of target nucleic acids, enabling early detection of pathogens or contaminants in agricultural products, minimizing the risk of foodborne illnesses and ensuring consumer safety. Moreover, MXenes' large surface area provides ample space for functionalization with specific probes or ligands, enabling selective binding to target nucleic acids. This specificity, coupled with the sensitivity of MXene-powered biosensors, allows for precise identification and differentiation of various pathogens or genetically modified organisms present in agricultural and food systems. Furthermore, the biocompatibility of MXenes ensures minimal interference with the target samples, preserving the integrity and quality of the analyzed food products [4,5].

Conclusion

MXene-powered nucleic acid biosensors have the potential to revolutionize agriculture and food safety practices. Their unique properties, including high conductivity, large surface area, and biocompatibility, make MXenes excellent candidates for enhancing the sensitivity and efficiency of biosensors. By enabling rapid and accurate detection of pathogens, contaminants, and genetically modified organisms in agricultural and food systems, MXene-powered biosensors can significantly improve food safety, reduce the risk of foodborne illnesses, and ensure the delivery of safe and high-quality food to consumers. Continued research and development in this field hold promise for further advancements in agriculture and food safety, contributing to a sustainable and secure food supply for the growing global population.

To enhance the performance of NA biosensors based on MXene. First, a thorough comprehension of the interactions between MXene and NA is essential. Although a number of studies have suggested that some ssDNA can chemically conjugate with MXene, no conclusive proof of this exists yet. Second, there is a need to foster profoundly stable ssDNA copies that have explicit acknowledgment capacities. Third, since in agri-food frameworks, on location testing is a high need, compact MXene-based NA biosensors, for example, sidelong stream examines and lab-on-a-chip gadgets are required. Some MXenes other than Ti3C2Tx, for example, Nb4C3 might be a reasonable substitute that can be generally embraced in the NA biosensors for synthetic objective identification.

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Conflict of Interest

There are no conflicts of interest by author.

References

1. Willemsen, Linda, Jan Wichers, Mang Xu and Richard Van Hoof, et al. "Biosensing chlorpyrifos in environmental water samples by a newly developed carbon nanoparticle-based indirect lateral flow assay." *Biosensors* 12 (2022): 735.

2. Lubin, Arica A. and Kevin W. Plaxco. "Folding-based electrochemical biosensors: The case for responsive nucleic acid architectures." *Acc Chem Res* 43 (2010): 496-505.

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3. McConnell, Erin M., Ioana Cozma, Devon Morrison and Yingfu Li. "Biosensors made of synthetic functional nucleic acids toward better human health." *Anal Chem* 92 (2019): 327-344.

4. Manzanares-Palenzuela, C. Lorena, Begoña Martín-Fernández, Marta Sánchez-Paniagua López and Beatriz López-Ruiz. "Electrochemical genosensors as innovative tools for detection of genetically modified organisms." *TrAC Trends Anal Chem* 66 (2015): 19-31.

5. Tian, Cheng, Lei Zhao, Jin Zhu and Shusheng Zhang. "Ultrasensitive detection of trace Hg2+ by SERS aptasensor based on dual recycling amplification in water environment." *J Hazard Mater* 416 (2021): 126251.

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