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Reusable Biosensor for Simple Unfiltered Saliva RNA Detection

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Introduction

The detection of RNA biomarkers in biological fluids such as saliva has gained significant interest in the field of diagnostic and molecular medicine. Saliva, as a non-invasive sample source, offers a convenient and cost-effective alternative to more invasive diagnostic procedures such as blood draws or tissue biopsies. Among the various potential applications of saliva-based diagnostics, the detection of RNA in unfiltered saliva stands out due to its potential in diagnosing a wide range of diseases, including viral infections, genetic disorders and even cancer. The development of a reusable biosensor for the simple detection of unfiltered saliva RNA holds promise for revolutionizing both point-of-care and remote diagnostics.

This paper explores the concept of a reusable biosensor designed for the detection of RNA in unfiltered saliva, discussing the underlying principles of RNA detection, the design and components of the biosensor, challenges faced in its development and the future potential of such a device in clinical and at-home diagnostic applications.

Description

Saliva contains a wide variety of biomolecules, including proteins, DNA and RNA, which can serve as valuable indicators of disease or physiological states. RNA, in particular, is a promising biomarker due to its direct involvement in the gene expression process and its rapid response to changes in the body. The detection of RNA from unfiltered saliva is advantageous because saliva is readily accessible and its collection is non-invasive, painless and can be easily performed without the need for trained medical personnel. Traditional methods for RNA detection, such as Reverse Transcription Polymerase Chain Reaction (RT-PCR) and quantitative PCR (qPCR), are sensitive and widely used in laboratories. However, these methods often require specialized equipment, time-consuming sample preparation and skilled operators, which makes them unsuitable for point-of-care or field diagnostics. Moreover, these methods typically rely on RNA extraction and purification from saliva, which can be cumbersome, expensive and prone to sample loss or degradation.

RNA biosensors can be broadly classified into two types: those that rely on direct detection of RNA and those that involve an amplification step. Direct detection methods measure the presence of RNA by recognizing its unique sequence or structure, while amplification-based methods, such as isothermal amplification, increase the amount of RNA to enhance the signal. In the context of a reusable biosensor for unfiltered saliva RNA detection, a direct detection method is more desirable. This approach simplifies the process, reduces the time and cost and avoids the need for complex amplification procedures. Several technologies can be used in RNA biosensors, including optical, electrochemical and piezoelectric transduction methods, each with its advantages and limitations [1,2].

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Conclusion

The development of a reusable biosensor for RNA detection in unfiltered saliva holds tremendous potential for revolutionizing diagnostics across a wide range of medical fields. While there are significant challenges to overcome, including ensuring RNA stability, minimizing interference from other biomolecules and optimizing sensitivity and specificity, recent advances in biosensor technology and nanomaterials provide promising solutions to these challenges. As research in this area progresses, we can expect to see the emergence of portable, cost-effective and highly sensitive RNA biosensors that can be used for both clinical and at-home diagnostics. By making RNA detection more accessible and efficient, these biosensors could play a key role in early disease detection, personalized medicine.

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