

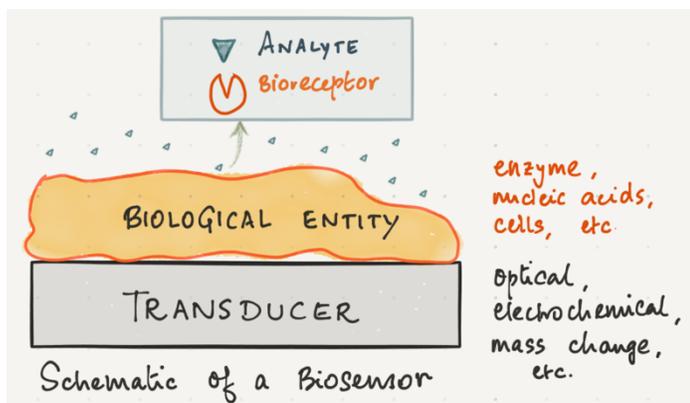
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BIOSENSORS

Detection of glucose in food / physiological samples

Introduction

A biosensor is a device that deploys biomolecules such as nucleic acids, enzymes, cells, antibodies, or other proteins to detect chemical compounds / biomolecules. A typical biosensor comprises a biological entity in direct contact with a transducer. The transducer exploits a specific physical principle (e.g. optical absorbance, fluorescence, electrochemical charge transfer) in order to convert the analyte concentration into a physical value. Key parameters for choosing a specific biosensor are sensitivity range, selectivity, response time, ease of preparation and the intended application.



Task

The task here is to determine the concentration of glucose in fruit juice and in blood. In food science is important to know the sugar concentration for dietary regulations. In blood, the concentration of glucose is an indicator of a health condition such as diabetes.

Questions

- Design a biosensor for estimating the concentration of glucose in a fruit juice of your choice and in human blood. Are any sample preparation procedures necessary before exposing the biosensor to the sample?
- Is glucose the only sugar in these samples? How would you ensure a high selectivity of your biosensor towards glucose, and avoid interference from other chemical species in the tested sample? What are the sample-relevant factors that may affect the selectivity during practical use?

- It is important that the designed biosensor works in the relevant concentration range. Survey the range of glucose concentration for various fruit juices (it is interesting to consider the various juice types in the supermarket next to you – ‘sugar-free’, containing natural sugar, organic, made from concentrate etc.) and compare them. What is the blood glucose level in a healthy individual? What can one infer when the blood glucose level is out of this range?
- Discuss how the proposed biosensor can be calibrated and reused. Also, discuss the experimental issues to be tackled in order to be sensitive in the correct concentration range.
- A typical biosensing assay is an analytical protocol in heterogeneous format. What aspects distinguish this format from a homogeneous format? Describe one method in a homogeneous format that may be used to arrive at the glucose concentration in fruit juice or blood. Compare this method with the biosensing strategy in terms of various analytical parameters and application potential.
- Discuss if and how it would be possible to adapt the proposed biosensing strategy to detect other sugars, for e.g. fructose in fruit juice.

Keywords

Electrochemical detection, enzymatic biosensors, glucometer / blood glucose meter, test strip(e)s, disposable, diabetes

References

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GAGO20 SIGMA Glucose Assay kit