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Extraction of Glucose Oxidase from *Aspergillus* Niger for Glucose Monitoring

Kettal Meriem El Batoul[1*], Chemlal Radia[2], Laribi Hassiba[3]

[1] Department of Process Engineering of Industrial Pharmacy, Faculty of Technology, University of Saad Dahleb Blida , Algeria

[2] Department of Process Engineering of Environmental Faculty of Technology, University of Saad Dahleb Blida, Algeria

[3]Faculty of Biology Science, University of Technology Science Houari Boumediene, Algeria

*Corresponding author's email: batoulkettal68@gmail.com

ABSTRACT

Diabetes is progressively emerging as a significant health challenge in Algeria, impacting individuals across various age groups. Inadequate management of diabetes may give rise to complications, underscoring the importance of effective disease control and care. The expenses associated with monitoring glucose levels show a consistent year-over-year increase and following to the current situation of our country's national policy to stop importing products and replace them with local products, encouraging national production. In this context, we searched for the viability of employing *Aspergillus niger* as a feedstock for fermentation-based glucose oxidase (GOX) synthesis. The aim was to increase overall GOX activity through the selection of an available substrate and the cultivation of microorganisms. After 168 hours of fermentation, the enzyme produced 2.6 µmole min^{-1} at a 10% glucose concentration. The ideal pH and temperature ranges for the synthesis of the enzyme were searched to be 5.0–6.0 and 30–35°C, respectively.

Keywords: Glucose oxidase, *Aspergillus niger*, GOX activity, Fermentation.

1. Introduction

Diabetes is a major public health problem, with a steady rise in the number of diabetes cases and in the prevalence of the disease over recent decades [1]. In response to this situation, numerous self-monitoring of blood glucose (SMBG) devices has emerged in recent years, and patients are increasingly involved in the management and monitoring of their disease through the use of these SMBG devices [2]. These include blood glucose test strips, which are in vitro diagnostic medical devices that can be used as diagnostic guidance tests [3]. The enzyme on which glucose detection kits are based is glucose oxidase. Also, a number of glucose sensors are available on the market using immobilized GOX [4]. The value of the global glucose biosensor market has been estimated at 548 billion $, corresponding to 11% of total healthcare expenditure worldwide. The forecast for 2035 is 627 billion $ [5]. In 2017, Algeria spent 434 million $ (51.3 billion Algerian Dinars) on drugs and strips for diabetic patients [6]. In the same year, the Caisse Nationale des Assurances Socials (CNAS) reimbursed around 13.5 billion DA a year for the cost of strips. The aim of this study is to have a local production of the enzyme GOX using *Aspergillus niger* as a source, at a low cost and a maximum yield.

2. Experimental

2.1 Micro-organism

The stain of *Aspergillus niger*, was maintained by periodical replication on potato dextrose agar (PDA) in petri dishes.

3. Results and Discussion

Enzyme activity was detected by Trinder assay, and the absorbances obtained at 505nm are shown in Table I. Absorbance peaked (ABS= 0.701) after 168h of fermentation.

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Table I: *Absorbance as a function of time*

Time (hour)	Absorbance (ABS)
0	0,09
24	0,245
48	0,261
72	0,296
96	0,259
168	0,701
192	0,309
216	0,369
240	0,372

Enzyme activity was calculated from these absorbances (Table I), and the results obtained are shown in Fig 1. From this figure, we can see that enzyme activity increases during the fermentation period between 24h and 168h, with maximum activity reached after 168h of production.

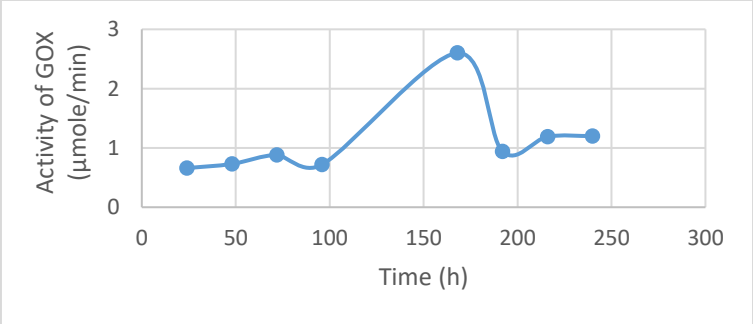

Figure 1: Activity of GOX as a function of time.

4. Conclusions

In this study, we focused on the production of the GOX enzyme from *Aspergillus niger* on an optimized culture medium at pH 5.5 and a temperature of 30°C. In the future, it would be interesting to complement this study with a purification of the enzyme and to see the effect of pH and temperature on the development of the culture. It is anticipated that GOX will have more commercial applications in the future due to advancements in technology.

References

[1]: World Health Organization, "WORLD REPORT ON DIABETES" Geneva, 2016.
[2]: F. Merette, L'autosurveillance du diabète, quel lecteur pour quel patient ? Rouen, 2015.
[3]: E. h. Rahhou, L'autosurveillance glycémique des patients diabétiques : des méthodes conventionnelles vers des méthodes non invasives, Lille, 2016.
[4]: Jeffrey D. Newman, Anthony P.F. Turner, Home blood glucose biosensors: a commercial perspective, Biosensors and Bioelectronics, Volume 20, Issue 12, 15 June 2005, Pages 2435-2453.
[5]: D. Federation « L'ATLAS DU DIABÈTE DE LA FID » 10th édition 2021.
[6]: Lakhdar Griene, Auto surveillance glycémique : De la performance analytique à la pertinence clinique, 21ème Congrès National de Diabétologie / SADIAB 14 – 16 novembre 2019 ; Hôtel El Aurassi, Alger.

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