Dataset on fabrication of an improved L-lactate biosensor based on lactate oxidase/cMWCNT/CuNPs/PANI modified PG electrode

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Article history:
Received 1 November 2016
Received in revised form 29 January 2018
Accepted 6 February 2018
Available online 12 February 2018

Keywords:
L-Lactate oxidase
Nanomaterials
Lactic acid
Plasma
Pencil graphite electrode
Covalent binding

Abstract
The data shown in this article are based on the original research article entitled "An improved amperometric L-lactate biosensor based on covalent immobilization of microbial lactate oxidase onto carboxylated multiwalled carbon nanotubes/copper nanoparticles/polyaniline modified pencil graphite electrode" (Dagar and Pundir, 2017) [1]. This article explains the fabrication of an amperometric L-lactate biosensor based on microbial lactate oxidase (LOx) covalent immobilization onto nanomatrix [(carboxylated multiwalled carbon nanotubes (cMWCNT)/copper nanoparticles (CuNPs)/polyaniline (PANI) hybrid film/pencil graphite electrode (PGE)]. The dataset based on this article is made publically available for critical analysis. The whole data is supplied in the research article instead of repository. The data in the article is not related to any already published article.

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The present work describes the construction of an amperometric lactate biosensor with improved response time, limit of detection, working range and storage stability. Biosensor can be used to measure lactate in plasma with high accuracy and specificity, which is an excellent indirect marker of cellular fatigue and critical in the patients suffering from lactoacidosis. The biosensor could be miniaturized into commercial model/portable model and thus could be used at the bedside of the patient. The biosensor showed better analytical performances than the earlier reported biosensor [2–4]. This data allows other researchers to fabricate another biosensor on the same nanomatrix with some modifications as the nanomatrix provided excellent results in the present biosensor.

1. Data

As mentioned in the article, the biosensor exhibited better analytical performances as compared to the other lactate biosensors. The some analytical characteristics are also described in this dataset such
as optimum scan rate and response time. The designed biosensor worked at optimum scan rate of 20 mV/s and with a rapid response time (5 s). Figs. 1–3 represent the effect of scan rate, incubation time on response of L-lactate biosensor and TEM images of copper nanoparticles.

2. Experimental design and materials and methods

2.1. Experimental design

1. Preparation and characterization of CuNPs.
2. Electrodeposition of cMWCNT/CuNPs/PANI onto PG electrode.
3. Immobilization of LOx onto cMWCNT/CuNPs/PANI onto PG electrode.
4. Physico-chemical characterization of enzyme electrodes at different stages of its construction.
5. Construction and testing of amperometric L-lactate biosensor.
6. Optimization of L-lactate biosensor.
7. Evaluation of L-lactate biosensors.
8. Application of L-lactate biosensor in determination of L-lactate in blood plasma in healthy persons and patients suffering from lactic acidosis.

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**Fig. 1.** Effect of scan rate to the response of Lactate Biosensor.

**Fig. 2.** Effect of response time on Lactate Biosensor.
2.2. Materials and methods

L-Lactate oxidase (LOx from Pediococcus species), (L-0638, LOx 100 units/mg) from Sigma Aldrich USA and carboxylated multi-walled carbon nanotubes (cMWCNTS) from Intelligent Materials Pvt. Ltd. Panchkula, tetraethylorthosilicate (TEOS) from Fluka Mumbai were used. All other chemicals (AR grade) were from SRL Mumbai. Double distilled water (DW) was used during the experimental studies. Blood plasma samples were collected from hospital of local Pandit Bhagwat Dayal Sharma Postgraduate Institute of Medical Sciences. Commercially available milk products, various wines prepared from purple grapes with brand name as Sauvignon Blanc, Cabernet Blend, Merlot, Nine Hills Chenin Blenc and Sula Chenin Blanc and beer (Brand name: Orangeboom, Hoegarden, Tsingtao, Heineken and Tuborg) were purchased from local market.

CuNPs were prepared by chemical reduction method [1], enzyme electrode was fabricated by immobilizing LOx onto cMWCNT/CuNPs/PANI modified PG electrode by EDC/NHS chemistry and lactate biosensor was constructed by connecting LO electrode with Ag/AgCl electrode and Pt wire through potentiostat. Biosensor's response was measured amperometrically. Biosensor was applied

Table 1

| SN. | Technique used                             | Value of technique                                      |
|-----|--------------------------------------------|---------------------------------------------------------|
| 1.  | TEM : Size                                 | 4.28, 6.35, 7.05, 8.07 nm                               |
|     | Shape                                      | Spherical                                               |
| 2.  | UV and visible spectra: Peak at            | 650 nm                                                  |
| 3.  | FTIR Spectra: Peaks at                    | (i) 2922.39 cm\(^{-1}\) (ii) 1028.20 cm\(^{-1}\) to    |
|     |                                            | 1056.90 cm\(^{-1}\) (iii) 1583.52 and 1047.88 cm\(^{-1}\) |
| 4.  | EIS Spectra: Rct value                    | 480 \(\Omega\), 245 \(\Omega\), 320 \(\Omega\)          |

Fig. 3. Transmission electron microscopic (TEM) images of CuNPs.
for determination of lactate in biological materials using standard curve between lactate concentration vs. current in mA under optimum working conditions (Tables 1 and 2).

**Transparency document. Supplementary material**

Transparency data associated with this article can be found in the online version at https://doi.org/10.1016/j.dib.2018.02.010.

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