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Electrochemical Devices with Faceplates Enabling Monitoring Diabetic Foot Ulcer

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Editorial

Chronic wounds are significant healthcare concerns that impact a significant proportion of diabetics. They are the major cause of limb amputation and impose a significant financial burden. Many of the issues connected with wound healing can be addressed by smart systems, devices with detecting, reacting, or reporting features, or a combination of these. Diabetic foot ulcers are characterised as inflammation and infection of deep tissues related with neurological problems and various forms of vascular disease in the human lower leg. The management of DFUs has become a concern for healthcare practitioners, owing to the rising incidence of diabetes, which now stands at 7% in India alone. According to reports, 25% of these people are predicted to develop DFU over their lifespan, with 12% requiring significant amputations. In the event of chronic DFUs, among other amino acids, the quantity of L-tyrosine in wound fluid rises rapidly [1].

It is expected that the worldwide population of diabetic patients will skyrocket by 2030, putting a significant strain on existing resources. The growing number of health-related issues has put a cap on the time-consuming and expensive standard clinical diagnostic techniques. Traditional DFU monitoring approaches include the Semmes-Weinstein monofilament test, 128 Hz tuning fork, and thermal imaging of the wound region, to mention a few. However, because these techniques cannot foresee the incidence of DFUs at the time of start, the wound is permitted to grow chronic and comorbid. These approaches have several main drawbacks, including increased cost and time consumption [2].

Existing methods for assessing the quantity of the required biomarker L-tyrosine, on the other hand, include high-performance liquid chromatography, mass spectrometry, and capillary electrophoresis. These approaches have significant limitations, including high costs, long reaction times, and a lack of mobility, the latter of which is a big problem in a point-of-care scenario. As a result, the need of the hour is to build a quick, efficient, and low-cost electronic gadget capable of monitoring a patient's status before it becomes deadly. Because of the increased surface to volume ratio, the use of nanomaterials in electrochemical biosensors has been extensively researched, bringing up possibilities for various functionalization and quantum confinement effects. MnO2 nanostructures have piqued the interest of researchers due to their non-toxic nature, which makes them suitable biocompatible sensing platforms. Choline oxidase (ChOx)/MnO_2/chitosan modified glassy carbon electrode voltammetric detection [3].

The electrocatalysis of choline chloride was observed to improve following the deposition of ChOx on -MnO_2 due to better redox kinetics at the electrode provided by the nanostructure's large surface area. The catalysis of phenolic species to their quinoid equivalent by tyrosinase, on the other hand, is widely recognised and used in biosensors. Wearable sensor technology is an expanding topic of study in biomedical instrumentation. The incorporation of nanomaterials with micro/nano-fluidic-based wearable sensors has applications in military, sports, and healthcare. These smart dressings may detect changes in physical factors such as temperature, moisture, blood pH, and so on, in addition to detecting numerous biochemicals or biomarkers [4].

A large number of studies reveal sensors created to monitor body temperature, heart rate ECG, and blood pressure; nevertheless, monitoring chronic wounds has received comparatively little attention created a smart bandage with capacitive and resistive sensors for measuring bleeding/pressure levels and the pH of fluids in the wound created a smart bandage to detect the presence of oxygen in wounds The sensor demonstrated a linear response for oxygen concentrations ranging from 2-30%, resulting in a sensitivity of 1.5 A/% and a reaction time of about 20s. Meanwhile, nanomaterials-modified smart wound dressings outperform their conventional counterparts due to improved sensitivity and detection limits over a wide analyte concentration range. [5].

Conflict of Interest

None.

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