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# Flexible MXene-Bacterial Cellulose Biosensor for Cortisol Detection in Real Samples

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Cortisol, a key stress biomarker, is one of the most potent hormones whose persistently high levels can induce disease. It plays crucial roles in energy metabolism, electrolyte balance, blood pressure regulation, and cognitive processes, and is commonly implicated in stress-related conditions [1]. Therefore, there is a growing demand for rapid, accurate, and non-invasive cortisol detection in clinical samples [2]. This study presents the development of a biosensor for cortisol using MXene ($Ti_3C_2T_x$) deposited on a bacterial cellulose (BC) membrane. A straightforward fabrication process was employed in which an adhesive mask defined interdigitated electrode patterns on the BC substrate prior to MXene deposition. Subsequently, the MXene-modified electrodes were functionalized with the conductive polymer polyethylenimine (PEI) and the immobilization of cortisol antibodies onto the electrode fingers was further performed. Electrical characterization confirmed the successful modification and high conductivity of the electrodes. Changes in the resistance and capacitance of the electrode upon different cortisol concentrations were used for the biomarker detection. The biosensor exhibited a good sensitivity towards cortisol and was able to detect it in real samples, thereby underscoring its potential for rapid, sensitive, and cost-effective analysis. Furthermore, the proposed platform shows promise for integration into wearable sensor devices, enabling its applicability in clinical diagnostics and health monitoring.

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**References**
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