Electrochemical Sensor Based on Hybrid Nanomaterials for Melatonin Detection in Human Saliva: A Potential Diagnostic Tool for Anxiety Disorders

Vasfiye Hazal ÖZYURT[1,2], **Nil Su Çaylayık[3]**, Burak Ekrem ÇİTİL[4], Fulden Cantaş TÜRKİŞ[5], **Ülkü Anık[1,3]**

[1] *Research Laboratory Center, Mugla Sitki Kocman University, Sensors, Biosensors and Nano-Diagnostic Systems Laboratory, Kotekli-Mugla, Türkiye*

[2] *Faculty of Tourism, Department of Gastronomy and Culinary Arts, Mugla Sitki Kocman University, Kotekli, Mugla, Türkiye*

[3] *Faculty of Science, Chemistry Department, Mugla Sitki Kocman University, 48000 Kotekli, Mugla, Türkiye*

[4] *Faculty of Medicine, Department of Medical Microbiology, Mugla Sitki Kocman University, Kotekli, Mugla, Türkiye*

[5] *Faculty of Medicine, Department of Biostatistic, Mugla Sitki Kocman University, Kotekli, Mugla, Türkiye*

nilsucyl@gmail.com

Anxiety disorders rank among the most prevalent mental health conditions worldwide. Despite their widespread occurrence, diagnosis remains challenging due to the subjective nature of questionnaire-based assessments. Indeed, studies suggest that up to 50% of individuals with anxiety disorders remain undiagnosed [1]. Recent findings have highlighted melatonin as a promising biomarker for the objective identification of anxiety disorders[1]. In this context, we developed a novel electrochemical sensor based on a carbon screen-printed electrode modified with a multi-walled carbon nanotube-gold-platinum (MWCNT-Au-Pt) nanocomposite for the sensitive detection of melatonin. Key experimental variables, including nanocomposite quantity and solution pH, were systematically optimized to enhance sensor performance. The sensor demonstrated two distinct linear response ranges for melatonin: 0.5 µM–50 µM with a detection limit of 0.23 µM, and 100 µM–1000 µM with a detection limit of 2.14 µM. Selectivity studies confirmed the sensor's high specificity even in the presence of potential interferents. Furthermore, the sensor was successfully utilized for melatonin quantification in 25 real human saliva samples using standard addition of three concentration levels. This study presents the first MWCNT-Au-Pt modified disposable sensor for melatonin detection, offering a practical and reliable tool that could facilitate more accurate diagnosis of anxiety disorders. Coupled with a portable potentiostat, this user-friendly biosensor holds great potential as a point-of-care diagnostic system for future clinical applications.

References

[1] K. Łoś, N. Waszkiewicz, Biological markers in anxiety disorders, J Clin Med 10 (2021).

Acknowledgement: The grant from Health Institutes of Turkey (TUSEB)- B coded with project no: 33042 was gratefully acknowledged.

Figures

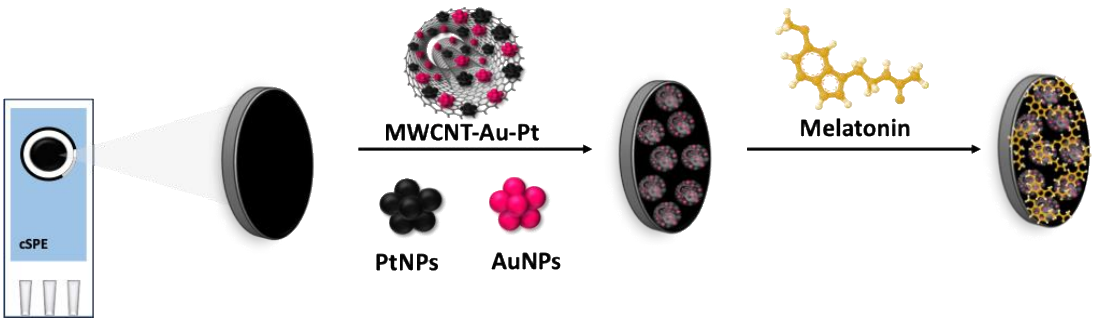

Figure 1: The schematic demonstration of fabrication of melatonin biosensor.