

Development of an electrochemical immunosensor based on a competition assay for C-peptide detection in human urine

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Abstract

Diabetes mellitus cases are reported to increase each year, affecting approximately 463 million of people worldwide by 2019 according to International Diabetes Federation [1]. C-peptide is a by-product of pancreatic beta cells, which is secreted in equal amounts along with insulin. One of the advantages of C-peptide is a longer half-life (30 minutes) compared to insulin (5 minutes) in the plasma. The presence of C-peptide in urine is closely linked to the metabolic situation, particularly reflecting insulin secretion [2]. In this multidisciplinary study, we aim to develop an electrochemical immunosensor based on competition approaches for the detection of C-peptide levels in urine samples. The method is based on antigen-antibody interactions that are specific for C-peptide. The reaction is performed on a gold screen-printed electrode surface, acting as the transducing element. The immobilization of a self-assembled monolayer, which has one functional group on each end facilitates the functionalization of activated C-peptide onto the surface of a gold screen-printed electrode through amine-amine interactions. By using C-peptide antibody, labelled with an enzyme (horseradish peroxidase) coupled to a chromogenic substrate (3,3',5,5'-tetramethylbenzidine, a reduced product is formed, which can be detected using pulsed amperometry. To visualise the result, a readout device (mobile phone or laptop) was used. The developed sensor is reliable, and specific with no known cross-reactivity to other related structures such as insulin. The limit of detection obtained was 0.325 µg/ml and 0.542 µg/ml when detecting C-peptide levels in buffer solution and urine sample, respectively

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Biography

Sharmaine Reintar, 25 years of age, was born in the Philippines. She finished her Bachelor studies by 2016 at the University of Northern Philippines and is a Registered Medical Technologist by profession. She has 1 year (2017-2018) of experience working in a clinical laboratory setting to analyze several body fluids in the

body. She got her Masters degree in nanoscience and nanotechnology at the Universitat Rovira I Virgili, Spain by 2019. She started her PhD study in 2020 at the Medical University of Graz, Austria, which is currently ongoing.