chemistry proceedings

MDPI

Abstract

Electrochemical Immunosensor for Simultaneous Determination of Emerging Autoimmune Disease Biomarkers in Human Serum †

Esther Sánchez-Tirado *, Sara Guerrero, Araceli González-Cortés, Lourdes Agüí, Paloma Yáñez-Sedeño and José Manuel Pingarrón

Department of Analytical Chemistry, Faculty of Chemistry, University Complutense of Madrid, Avda. Complutense s/n, 28040 Madrid, Spain

* Correspondence: esther.sanchez@ucm.es

† Presented at the 1st International Electronic Conference on Chemical Sensors and Analytical Chemistry, 01—15 July 2021; Available online: https://csac2021.sciforum.net/.

Abstract: Rheumatoid arthritis is an autoimmune disorder characterized by persistent erosive synovitis, systemic inflammation and the presence of autoantibodies, which play an important role in inducing inflammation and joint damage, releasing pro-inflammatory cytokines from monocytes and macrophages [1,2]. Likewise, neutrophil activating protein-2 (CXCL7) is a platelet-derived growth factor belonging to the CXC chemokine subfamily, which is expressed in serum, synovial fluid and synovial tissue of patients developing rheumatoid arthritis during the first twelve weeks, being useful to reflect local pathological changes [3]. Besides, matrix metalloproteinase-3 (MMP-3), which is induced by inflammatory cytokines such as interleukin-1 (IL-1) and tumor necrosis factor alpha (TNF-α) in rheumatoid synovium, degrades several extracellular matrix components of cartilage and plays central roles in rheumatoid joint destruction [4]. Thereby, monitoring serum CXCL7 and MMP-3 levels is useful for predicting the disease activity in rheumatoid arthritis. In this work, the construction and analytical performance of a dual electrochemical platform for the simultaneous determination of CXCL7 and MMP-3 is described. After the optimization of experimental variables involved in the preparation and implementation of the biosensor, the analytical usefulness of the developed configuration was demonstrated by its application to the determination of these biomarkers in serum samples from healthy individuals and patients with rheumatoid arthritis. In addition, the results obtained using the dual immunosensor were compared with those provided by the respective ELISA immunoassays, yielding no significant differences between the two methods.

Keywords: rheumatoid arthritis; CXCL7; MMP-3; immunosensor; simultaneous determination; human serum samples.

Published: 01 July 2021

Author Contributions: Conceptualization, P. Yáñez-Sedeño; methodology, E. Sánchez-Tirado, S. Guerrero, A. González-Cortés and L. Agüí; software, E. Sánchez-Tirado and S. Guerrero; validation, E. Sánchez-Tirado, S. Guerrero, A. González-Cortés and L. Agüí; formal analysis, E. Sánchez-Tirado, S. Guerrero, A. González-Cortés and L. Agüí; investigation, E. Sánchez-Tirado, S. Guerrero, A. González-Cortés and L. Agüí; resources, A. González-Cortés, L. Agüí and P. Yáñez-Sedeño; data curation, E. Sánchez-Tirado and S. Guerrero; validation, E. Sánchez-Tirado, S. Guerrero, A. González-Cortés L. Agüí, P- Yáñez-Sedeño; writing—original draft preparation, E. Sánchez-Tirado, S. Guerrero, A. González-Cortés, L. Agüí and P. Yáñez-Sedeño; writing—review and editing, P. Yáñez-Sedeño and J.M. Pingarrón; visualization, E. Sánchez-Tirado, S. Guerrero, A. González-Cortés and L. Agüí; resources, A. González-Cortés, L. Agüí and P. Yáñez-Sedeño; supervision, A. González-Cortés, L. Agüí, P. Yáñez-Sedeño; funding acquisition, A. González-Cortés, P. Yáñez-Sedeño. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Spanish Ministerio de Ciencia, Innovación y Universidades, grant number RTI2018-096135-B-I00 and TRANSNANOAVANSENS-CM Program from the Comunidad de Madrid, grant number S2018/NMT-4349.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Bos, W.H.; Wolbink, G.J.; Boers, M.; Tijhuis, G.J.; de Vries, N.; van der Horst-Bruinsma, I.E.; Tak, P.P.; van de Stadt, R.J.; van der Laken, C.J.; Dijkmans, B.A.C.; van Schaardenburg, D. Arthritis development in patients with arthralgia is strongly associated with anti-citrullinated protein antibody status: a prospective cohort study. *Ann Rheum Dis* **2010**, *69*, 490–494.
2. Scott, D.L.; Wolfe, F.; Huizinga, T.W.J. Rheumatoid arthritis. *Lancet*, **2010**, *376*, 1094–1108
3. Guerrero, S.; Cadano, D.; Agüí, L.; Barderas, R.; Campuzano, S.; Yáñez-Sedeño, P.; Pingarrón, J.M. Click chemistry-assisted antibodies immobilization for immunosensing of CXCL7 chemokine in serum. *J Electroanal Chem* **2019**, *837*, 246–253.
4. Sugiyama, E. Role of matrix metalloproteinase-3 in joint destruction in rheumatoid arthritis. *Clin Calcium* **2007**, *17*, 528–534