

Abstract

Indirect Detection of Acrylamide Using a Novel Biosensor Element [†]

Anja Korent , Kristina Žagar Soderžnik * , Špela Trafela  and Kristina Žužek Rožman

Department for Nanostructured Materials, Jožef Stefan Institute, Jamova Cesta 39, 1000 Ljubljana, Slovenia

* Correspondence: kristina.zagar@ijs.si

[†] Presented at the 9th International Symposium on Sensor Science, Warsaw, Poland, 20–22 June 2022.

Abstract: Acrylamide (AA), C₃H₅NO, is used worldwide in the synthesis of polymers and gels for wastewater treatments and in the paper industry. Naturally, it is formed in heat-treated food, mostly during the frying and baking of potatoes, cereals, and coffee beans. Its presence in food is dangerous as it is a neurotoxic and genotoxic compound. Triggered by new EU regulations, there is a high demand for reliable and cost-effective sensors in food and home appliances. In view of this, electrochemical sensors show high potential for the detection of toxic compounds. In the present work, we show the development of electrochemical biosensor elements, since AA is a non-active molecule and direct electrochemical detection is not possible. The sensors' receptor element is based on modified commercial screen-printed electrodes (SPEs) that offer on-site and cost-efficient sensing. As an electrochemical transducer, conductive polyaniline (PANI) decorated with Au NPs was applied, enabling high sensitivity and limit of detection below the 10^{−6} M range. As a biological component, enzyme amidase was selected, since it is known that it catalyzes the hydrolysis of acrylamide into carboxyl acid and ammonia. The ammonia was finally detected using chronoamperometry. The chemical interaction between PANI and ammonia is well-known and thus was used as a base for the fabrication of an amperometric sensory platform for its aqueous detection at neutral pH. To understand AA and amidase interaction and decomposition into ammonia, PANI electrochemical synthesis and redox behavior in acidic and neutral media were used to study the mechanism of AA indirect detection.

Keywords: electrochemical sensors; polyaniline; toxic organic compounds; acrylamide; screen-printed electrodes



Citation: Korent, A.; Soderžnik, K.Ž.; Trafela, Š.; Rožman, K.Ž. Indirect Detection of Acrylamide Using a Novel Biosensor Element. *Eng. Proc.* **2022**, *21*, 45. <https://doi.org/10.3390/engproc2022021045>

Academic Editors: Piotr Lesiak, Tomasz Woliński and Leszek Jaroszewicz

Published: 31 August 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Author Contributions: A.K., Š.T. and K.Ž.S. investigation, K.Ž.S. writing—original draft preparation, A.K., Š.T. and K.Ž.R. writing—review and editing. All authors have read and agreed to the published version of the manuscript.

Funding: The authors acknowledge the project (High performance nanostructured acrylamide sensors, ID J2-1739) which is financially supported by the Slovenian Research Agency.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

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