proceedings

MDPI

Abstract

Eco-Friendly Synthesized Silver-Nanoparticle-Modified PVA/PEG Hydrogels †

Katarzyna Sala [1,*], Magdalena Bańkosz [1,*], Hubert Placek [2], Julia Sztrumpf [2], Magdalena Kędzierska [3] and Bozena Tyliszczak [1,*]

[1] Department of Materials Engineering, Faculty of Materials Engineering and Physics, Cracow University of Technology, 31-864 Krakow, Poland
[2] Department of Physics, Faculty of Materials Engineering and Physics, Cracow University of Technology, 31-864 Krakow, Poland; hubert.placek@student.pk.edu.pl (H.P.); julia.sztrumpf@student.pk.edu.pl (J.S.)
[3] Department of Chemotherapy, WWCOiT Copernicus Hospital, Medical University of Lodz, 90-549 Lodz, Poland; kameleonmagda6@gmail.com
* Correspondence: katarzyna.sala@student.pk.edu.pl (K.S.); magdalena.bankosz@pk.edu.pl (M.B.); bozena.tyliszczak@pk.edu.pl (B.T.)
† Presented at the 3rd International Electronic Conference on Biomolecules, 23–25 April 2024; Available online: https://sciforum.net/event/IECBM2024.

Keywords: silver nanoparticles; yellow tea extract; biomaterials

This study introduces an advanced approach in the development of hydrogels, utilizing Polyvinyl Alcohol (PVA) and Polyethylene Glycol (PEG), integrated with eco-friendly synthesized silver nanoparticles. The synthesis of these nanoparticles was achieved using silver nitrate and yellow tea extract, a naturally reducing agent, ensuring an environmentally conscious production process. The incorporation of these silver nanoparticles into the PVA/PEG hydrogel matrix led to the creation of hydrogels with superior antibacterial properties. These enhanced properties render the hydrogels highly effective for various biomedical applications, including wound dressings and drug delivery systems. Notably, the addition of yellow tea extract not only underscores the commitment to eco-friendly synthesis but also potentially augments the bioactive characteristics of the hydrogels. This pioneering method aligns with green chemistry principles, signifying a notable advancement in sustainable hydrogel technology. The hydrogels' unique composition and characteristics open up a broad spectrum of possibilities in the biomedical field. This study not only demonstrates the practical applicability of these hydrogels in medical settings but also emphasizes the importance of sustainable practices in scientific research and material development.

The main objective of the analyses conducted was to understand the release of silver nanoparticles from the hydrogel material under different conditions, such as static and dynamic environments, and to determine the kinetics of this process. Spectrophotometric and microscopic analysis techniques were used in this research. The amounts of released nanoparticles and observations of morphological changes in the hydrogel structure were monitored. An analysis of the release kinetics provided a better understanding of the rate and manner in which nanoparticles leave the hydrogel structure under different conditions, which is essential for the optimal design of products based on these materials. This research formed an important experimental part of the work, contributing to the necessary knowledge needed for further development and practical use of silver nanoparticle hydrogel.

Author Contributions: Conceptualization, M.B. and B.T.; methodology, M.B., B.T., M.K. and K.S.; software, M.B., B.T., M.K., H.P. and J.S.; validation, M.B., B.T. and M.K.; formal analysis, M.B., K.S. and B.T.; investigation, M.B., K.S., H.P. and J.S.; resources, M.K. and B.T.; data curation, M.B. and B.T.; writing—original draft preparation, M.B., B.T. and M.K.; writing—review and editing, M.B. and

check for updates

Citation: Sala, K.; Bańkosz, M.; Placek, H.; Sztrumpf, J.; Kędzierska, M.; Tyliszczak, B. Eco-Friendly Synthesized Silver-Nanoparticle-Modified PVA/PEG Hydrogels. *Proceedings* **2024**, *103*, 28. https://doi.org/10.3390/proceedings2024103028

Academic Editor: Martin Muschol

Published: 12 April 2024

Copyright: © 2024 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/).

B.T.; visualization, M.B., H.P., J.S. and K.S.; supervision, B.T.; project administration, B.T., M.K. and M.B.; funding acquisition, M.K. and B.T. All authors have read and agreed to the published version of the manuscript.

Funding: The research work was funded at 3rd edition of the program "Student research clubs create innovation" through the project titled, "Transdermal systems in targeted therapy of skin cancer" financed by the Ministry of Science and Higher Education (grant no: SKN 157/568410/2023).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data that support the findings of this study are contained within the article.

Acknowledgments: The research work was carried out within the SMART-MAT Functional Materials Science Club (section Smart-Mat) at the Faculty of Materials Engineering and Physics of the Cracow University of Technology.

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

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.