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Magdalena Gierszewska

Dr. Magdalena Gierszewska is a researcher at the Faculty of Chemistry, *Nicolaus Copernicus University in Toruń, Poland*, specializing in polymer and materials chemistry, with a particular focus on natural polymers and the development of functional biopolymer-based materials. Her research is centered primarily on chitin and chitosan, including the design, modification and physicochemical characterization of films, coatings, hydrogels and other polymeric systems intended for applications in food packaging,

biomedicine and pharmacy.

A major part of her scientific activity concerns the modification of chitosan-based materials through plasticization, ionic and covalent crosslinking, incorporation of natural bioactive compounds, deep eutectic solvents and other functional additives. Her work combines material design with comprehensive characterization of structure-property relationships, including mechanical, thermal, surface, swelling, barrier and biological properties. She has also been involved in research on biodegradable packaging materials, antimicrobial and antioxidant systems, polymer-solvent interactions and the processing of chitin and chitosan.

She has authored or co-authored more than 40 publications indexed in Scopus and has an h-index of 24. Her research has been conducted within interdisciplinary and international collaborations, including Universidad Carlos III de Madrid, Aarhus University, University of Bologna, University of Ljubljana. She has also been involved in research groups focused on biodegradable packaging materials and biomaterials.

Alongside her research activity, she serves as Editor-in-Chief of Progress on Chemistry and Application of Chitin and its Derivatives and is actively involved in the scientific community working on chitin, chitosan and related biopolymers. Her current research interests focus on designing multifunctional, sustainable polymeric materials and understanding how chemical modification and formulation affect their physicochemical and functional performance.

Talk 1: Ionic and covalent crosslinking of chitosan: From network formation to material performance

Crosslinking is one of the key approaches used to control the structure, stability and functional properties of chitosan-based materials. The presentation will address ionic and covalent crosslinking strategies and their consequences for the organization and behaviour of chitosan networks. The relationship between crosslinking mechanisms and material properties, including swelling, solubility, mechanical performance, transport properties and stability, will be considered. Particular emphasis will be placed on how the selection and extent of crosslinking can be used to tailor chitosan-based films, hydrogels and related systems for different

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applications, while also considering the main limitations and trade-offs associated with individual crosslinking approaches.

Talk 2: Chitosan-based materials for active and intelligent packaging: From functionality to application

Chitosan offers a versatile platform for the development of active and intelligent packaging materials due to its film-forming ability, chemical functionality, biocompatibility and potential biological activity. The presentation will focus on strategies used to introduce active and responsive functions into chitosan-based films and coatings, with particular emphasis on the relationships between material composition, structure and functional performance. Selected approaches involving antimicrobial and antioxidant agents, natural extracts and stimuli-responsive components will be discussed together with their influence on physicochemical, mechanical and barrier properties. Particular attention will also be given to the challenges associated with translating multifunctional chitosan-based systems into practical packaging applications.



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