

Synthesis and Characterization of Novel β -cyclodextrin-Grafted Chitosan Hydrogels [†]

Sergio R. Ribone ¹, Juan P. Cerutti ^{1,2}, Wout De Leger ², Antonella V. Dan Córdoba ¹, Marcela R. Longhi ¹, Mario A. Quevedo ¹, Mario Smet ³, Wim Dehaen ², Ariana Zoppi ^{1,*}

¹ Unidad de Investigación y Desarrollo en Tecnología Farmacéutica (UNITEFA-CONICET), y Departamento de Ciencias Farmacéuticas, Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, Córdoba, Argentina; sribone@unc.edu.ar (S.R.); jpcerutti@unc.edu.ar (J.C.); antonella.dan@unc.edu.ar (A.D.); mrlonghi@unc.edu.ar (M.L.); aquevedo@unc.edu.ar (A.Q.); azoppi@unc.edu.ar (A.Z.)

² Laboratory of Organic Synthesis, KU Leuven, Leuven, Bélgica; juanpablo.cerutti@kuleuven.be (J.C.); wout.deleger@kuleuven.be (W.D.L.); wim.dehaen@kuleuven.be (W.D.)

³ Laboratory of Polymer Chemistry and Materials, KU Leuven, Leuven, Bélgica; mario.smet@chem.kuleuven.be (M.S.)

* Correspondence: wim.dehaen@kuleuven.be (W.D.); azoppi@unc.edu.ar (A.Z.)

[†] Presented at The Sixth International Meeting of Pharmaceutical Sciences (RICiFa), November 10-12, 2021, Córdoba, Argentina

Received: 26.04.2022; Revised: 4.05.2022; Accepted: 6.05.2022; Published: 8.05.2022

Abstract: The design and development of hydrogels obtained by a combination of chitosan and cyclodextrin constitute a highly relevant scientific topic regarding the obtention of controlled-release polymeric matrices. The main purpose of this study was the synthesis and characterization of novel β -cyclodextrin-grafted chitosan (CD-f-CS) hydrogels intended to be employed as sustained drug delivery devices. The CD-f-CS hydrogels were synthesized by reductive amination using monoaldehyde- β -CD and different ketones, whose molar ratio was varied to diversify the resulting hydrogels. The successful grafting of β -CD onto chitosan was confirmed by FTIR and NMR. The morphology of the hydrogels was characterized by SEM, showing a porous structure, and their viscoelastic properties were studied by rheological measurements. The storage modulus (G') was always higher than the loss modulus (G''), and there were no crossover points, indicating that the hydrogels have the characteristic gel structure. By increasing the length and/or the amount of the ketone used for their synthesis, weaker and more stable hydrogels with larger pore sizes are obtained. The observed rheological behavior suggests that synthesized CD-f-CS are expected to be efficient drug delivery carriers.

Keywords: hydrogel; chitosan; β -cyclodextrin; rheological properties.

© 2022 by the authors. 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/>).

Funding

This research was funded by Fondo para la Investigación Científica y Tecnológica, grant number PICT 2019-2664, and Consejo Nacional de Investigaciones Científicas y Técnicas grant number PIP 2015-2017, N° 112 201301 00485.

Acknowledgments

This research has no acknowledgment.

Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.