Converting Waste Materials into Biomaterials: Enriched calcium zeolites synthed from chickeneggshells for hemostatic applications

Guilherme de Paula Guarnieri[1], Jose Geraldo Nery[2,3], Ivana Conte Cosentino[4]

[1]São Paulo State University (*Física*), [2]Universidade Estadual Paulista, [3]São Paulo State University (*Physics*), [4]Instituto de Pesquisas Energéticas e Nucleares

e-mail: guilherme.guarnieri@unesp.br

Guilherme de Paula Guarnieri1, Ivana Conte Cosentino², José Geraldo Nery1
¹ São Paulo State University - UNESP, ² Nuclear and Energy Research Institute – IPENe-mail: guilherme.guarnieri@unesp.br

Abstract

Although there is a plethora of 245 different zeolites with different frameworks with unique and unusual topologies of channels and cavities with large applications in the field of industrial catalysis [1], few of them have found systematic biomedical applications, especially for the purpose of hemorrhage control. Hemostasis is a complex biochemical process in which the assembly of substrates, enzymes, protein cofactors and calcium ions ona phospholipid surface accelerates the rate of coagulation. Several inorganic solid matrices have been employed as topic hemostatic agents, and among them zeolites [2]. However, the synthesis of enriched calcium zeolites for the purpose of hemorrhage control and using as raw materials chicken eggshell biomass is an unexplored field of research. We report the data of the synthesis of four calcium zeolites using CaCO3 derivated from chicken eggshell. Thromboelastographic results using the pristine calcium enriched zeolites show that they were able to promote a faster clot formation and a higher maximum clot strength than those of the commercial topical hemostatic agent QuikClot.

Acknowledgements

FAPESP, CAPES and CNPq have supported this work.

References

[1] Fernandez, S., Ostraat, M. L., Zhang, K. (2020). Toward rational design of hierarchical beta zeolites: An overview and beyond. In AIChE Journal (Vol. 66, Issue 9). Wiley. https://doi.org/10.1002/aic.16943

[2] Malik, A., Rehman, F. U., Shah, K. U., Naz, S. S., Qaisar, S. (2021). Hemostatic strategies for uncontrolled bleeding: A comprehensive update. In Journal of Biomedical Materials Research Part B: Applied Biomaterials (Vol. 109, Issue 10, pp. 1465-1477). Wiley. https://doi.org/10.1002/jbm.b.34806