XXI Brazilian Meeting on Inorganic Chemistry
X Brazilian Meeting on Rare Earths
III Workshop on Theoretical Bioinorganic Chemistry
Belo Horizonte, September 12 - 15th 2024

Encapsulation of $[Bi(NAC)_3]^{3-}$ and metronidazole in gastroretentive and mucoadhesive polymeric nanosystems for *Helicobacter pylori* treatment

Fábio H. Moreira [1], Érika Lorena. F. C. de Alvarenga [2] and Priscila P. Silva Caldeira[1]

[1] *Centro Federal de Educação Tecnológica De Minas Gerais (CEFET), Belo Horizonte, Brazil*
[2] *Universidade Federal de São João del Rei, São João del Rei, Brazil*

E-mail: priscila@cefetmg.br

Thematic Area: Materials Chemistry

Keywords: Chitosan, bismuth, nanoformulation

Helicobacter pylori (H. Pylori) is a bacterium that can cause gastric ulcers and even lead to gastric cancer[1]. Its treatment involves medications like proton pump inhibitors, antibiotics, and adjuvants as bismuth salts and N-acetylcysteine (NAC)[1]. Despite this variety of treatments, its efficacy may be compromised by antibiotic resistance and poor drug absorption. However, encapsulating drugs in polymeric nanoparticles (NPs) could improve their bioavailability. In this study, NPs were loaded with metronidazole (Met) and/or $[Bi(NAC)_3]^{3-}$, a complex that promotes the stabilization of bismuth under gastric conditions[1] and enhances its absorption. To improve the mucoadhesive properties of chitosan (CHI), a covalent conjugation of NAC to its structure (CHI-NAC)[2] was performed. CHI and CHI-NAC NPs were later prepared by encapsulating $[Bi(NAC)_3]^{3-}$ and metronidazole by ionotropic gelation with sodium tripolyphosphate (TPP). Following the synthesis of $[Bi(NAC)_3]^{3-}$ and CHI-NAC, their structures were confirmed by spectroscopy (Ultraviolet/Infrared) and differential scanning calorimetry (DSC). The NPs were characterized according to size by dynamic light scattering (DLS), polydispersity index (PDI), and zeta potential (ZP) (Table 1). The resultant particles were in nanosized range and exhibited a positive ZP higher than +30mV, indicating the stability of the NPs in solutions. In addition, PDI values suggested that the NPs have a narrow size distribution. It was observed interactions between the polymers and the active ingredients in the NPs through FTIR analysis, as evidenced by the presence of characteristic bands of active ingredients. Currently, it is being conducted studies to assess the drug encapsulation efficiency (EE), drug release profile in simulated gastric fluid and cell biocompatibility assays.

Table 1 – Parameters of chitosan-based NPs prepared: particle size, polydispersity index, and zeta potential.

Sample		$[Bi(NAC)_3]^{3-}$ (%)	Met. (%)	Size (nm)	PDI	ZP (mV)
NPs CHI	1	0	0	185±2	0,33±0,01	+ (41,9±0,6)
	2	0	25	207±6	0,30±0,02	+ (34,7±3,6)
	3	25	0	340±18	0,45±0,02	+ (30,4±0,4)
	4	25	25	368 ±57	0,45±0,02	+ (35,5 ±3,1)
NPs CHI-NAC	5	0	0	166±8	0,52±0,03	+ (37,3±0,3)
	6	0	25	150±5	0,44±0,06	+ (36,8±0,4)
	7	25	0	241±12	0,46±0,03	+ (33,8±0,7)
	8	25	25	171±15	0,40±0,06	+ (33,5±0,1)

Acknowledgments: FAPEMIG, CNPq, CEFET-MG, PPGMQ-MG, and Rede Mineira de Química

References

[1] J. S. Rosário *et al.*, Molecules, **28**, 5921 (2023).
[2] M. Perrone *et al.*, Eur. J. Pharm. Biopharm., **132**, 103 (2018).