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Optimization of the functionalization method of titanate nanotubes in order to use them as drug delivery systems

Yasmin Ranjous[1], Dóra Kósa[2], Zoltán Ujhelyi[2], Géza Regdon jr.[1], Krisztina Anita Nagy[3], Zoltán Kónya[3,4], Ildikó Bácskay[2], Tamás Sovány[1]

[1]Institute of Pharmaceutical Technology and Regulatory Affairs, University of Szeged, Szeged, Hungary
[2]Department of Pharmaceutical Technology, University of Debrecen, Debrecen, Hungary
[3]Department of Applied and Environmental Chemistry, University of Szeged, Szeged, Hungary
[4]MTA-SZTE Reaction Kinetics and Surface Chemistry, Research Group, Szeged, Hungary

In the first step of the study, the production process and product quality of TNT composites with atenolol and hydrochlorothiazide [1] were successfully optimized. Nevertheless, to use titanate nanotubes (TNTs) as drug delivery systems, the tailoring of their surface characteristics and hydrophilicity may be essential. Trichlorooctylsilane (TCOS), trichloroocatdecylsilane (TCOdS) and Mg stearate (MgSt) were used as functionalizing agents to increase their permeability through the GIT.

In this step, the functionalized TNTs were characterized by using a vario EL cube elemental analyzer to determine the H, C, N, and S contents and an optical contact angle tester to investigate the surface free energy. Furthermore, Caco-2 cell lines were utilized to test the cytotoxicity of the functionalized TNTs with MTT assay as well as permeability, where the concentration of the permeated amount was determined with an X-ray fluorescent analyzer.

According to the OCA results, for silane-based materials there was no significant difference in the polarity of TNTs when using the different molecular sized TCOS and TCOdS. There was a proportional linear relationship between the concentration of the agent and the polarity of TNTs, and the maximum hydrophobicity was achieved by using 100 µL of both, therefore, the functionalization reagent may be selected on an economical basis. In contrast, the surface characteristics of TNTs showed a sigmoidal relation to MgSt, which enables the use of less St and more uploaded drug molecules. Furthermore, functionalization with MgSt is a water-based green method, and altogether seems to be a better choice to achieve the targeted aims.

References

1 Ranjous Y. et al. Nanomaterials, 9(10), 1406 (2019)

Supervisors: Tamás Sovány, Géza Regdon jr., Zoltán Kónya