# Halloysite nanotubes as multifarious drug delivery systems: is selective functionalization possible?

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Halloysite is an aluminosilicate clay, which naturally comes in the form of nanotubes. One of the most interesting fields of application of these materials is nanomedicine, where their peculiar morphology and low cytotoxicity can be exploited to deliver theragnostic agents to target tissues inside the organism [1]. Halloysite represents one of the rare nanotube systems with a different composition of the inner and outer surfaces, respectively composed by aluminum oxo-hydroxide and silica. This fairly unique structural ambivalence is a potent tool that can be exploited to modify separately the two surfaces, assigning them different tasks. Nonetheless, selective functionalization of halloysite nanotubes is scarcely investigated in the literature [2], as precisely defining the nature and location of molecule adsorption is a complex matter. To help sort this issue out, in this work surface modification of halloysite was carried out alongside the functionalization of purposely prepared model oxides mimicking the inner and outer surfaces, both in the form of powders and thin films. Phosphonic acids were chosen as functionalizing agents as they are known for adsorbing covalently on oxide substrates. Surface modification was followed by several techniques as FTIR, ζ-potential, BET and contact angle measurements, particularly relevant due to the presence of hydrophobic chains in the molecule [3]. The role of different parameters was investigated, changing impregnation times and solution pH, while also checking adsorption reversibility. Finally, the selective loading of gold nanoparticles, via a thiolated phosphonic acid linker, inside the inner lumen of halloysite nanotubes will be presented on the grounds of HR-TEM images.

REFERENCES

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