Silica nanotubes: From the preparation to Drug loading and controlled release

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Effective disease targeting represents an enormous biomedical challenge in the treatment of several diseases such as cancer because the lack of selectivity of current therapeutic agents results in numerous severe side effects. Thus, it becomes increasingly important to develop drug delivery systems that can efficiently target based on subtle molecular alterations that distinguish specifically injured cells. High aspect ratio nanoparticles, such as nanotubes and nanowires, are inorganic hollow structures that constitute potential candidates for drug delivery since their dimensions are easily varied and a wide range of functionality can be conferred to them [1].

In this work, we provide evidence that our silica nanotubes (SNTs) synthesis method has the advantage of forming Si-O-H chemical bonds at the nanotube's surface, allowing direct aminosilane functionalization [2]. However, the number of OH groups was found to decrease with the increase of calcination temperature. An optimum calcination temperature around 220^{o}C was found that compromises nanotube mechanical stability and OH group availability. Then, among the three tested aminosilane molecules (APTES) showed to have the most effective attachment to the inner surface of the nanotubes. Finally, using the efficient functionalization with amino-silane, the inner void of SNTs was used to control the release of a non-steroidal anti-inflammatory (naproxen) promoted by a polycationic surface drug loading.

References

[1] S. J. Son, et al., Drug Discovery Today (2007), 12, 650.
[2] Corine Tourné-Péteilh, et al., NJC Letters (2003), 27, 1415.

Figures

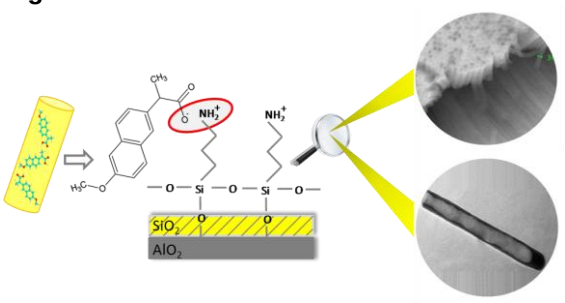

Figure1. Scheme of drug loading in inner surface of silica nanotubes.