Sweet Nanomaterials: Carbohydrate-Coated Carbon Nanotubes and Glyconanosomes as Advanced Nanovectors for Drug Delivery.

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Single-walled carbon nanotubes (SWCNTs)[1] have received an unrivalled interest as consequence of their unique structural, mechanical, electrical, and optical properties that make them promising candidates for biomedical applications.[2,3] To overcome their inherent insolubility in biological media various approximations, including covalent and non-covalent functionalization, have been developed. Nevertheless, these methods suffer from important drawbacks such as the low stability of the obtained aggregates or the disruption of π-electronic character of the CNTs sidewalls. In order to solve these problems, we have recently reported a *bottom-up* approach based on the supramolecular self-organization of diacetylenic-based glycolipids on the SWCNTs sidewalls, followed by photo-polymerization to form polydiacetylene glycolipid-coated nanotubes.[4-7] By using this methodology, the resulting nano-assemblies are water soluble, highly stable and show a biomimetic and multivalent presentation of carbohydrates on their surface, and besides, without altering the physico-chemical properties of the inner tube.[7]

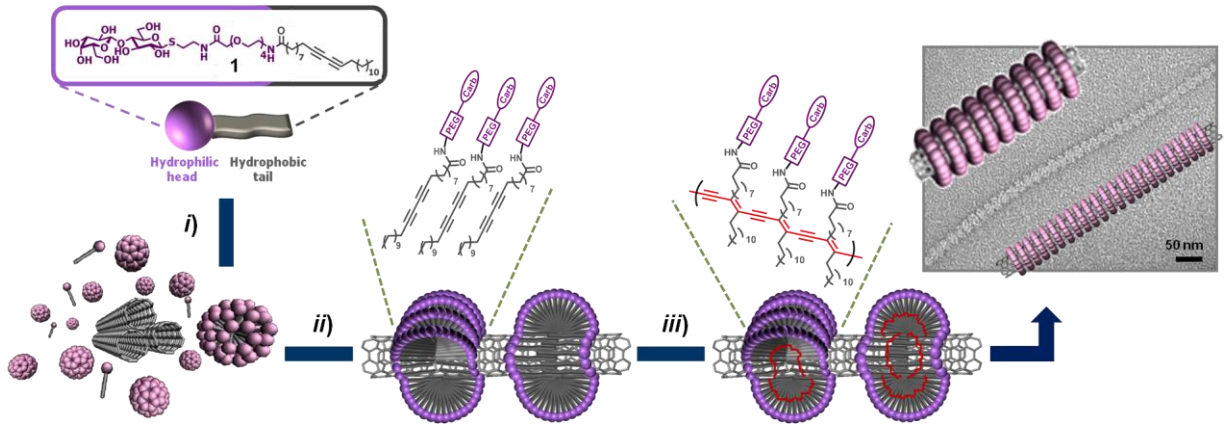

Figure 1. *Supramolecular self-assembly and photopolymerization of diacetylenic-based glycolipid **1** on the nanotube surface, and TEM characterization showing the abacus-like topology of the nanoconstructs.*

In the present communication, we are aimed at discussing: *a*) the synthesis and characterization of glyconanoring-coated SWNTs with **1**-type glycolipids (Figure 1), *b*) their selective binding to lectins (Figure 2A) and their specific aggregation of uropathogenic *Escherichia coli* bacteria (Figure 2B), and *c*) the glyconanoring sliding out of the carbon nanotubes to afford a new class of disk-shaped amphiphilic biomaterials named *glyconanosomes* (GNSs) (Figure 3).

Hence, the ability of GNSs to encapsulate lipophilic molecules will be presented, together with comparative results of *in vitro* activity of their inclusion complex with camptothecin (CPT) (GNS/CPT) as nanoparticle-based drug delivery systems of 3rd generation for the controlled delivery of CPT in the inhibition of carcinogenic cell proliferation.[8]

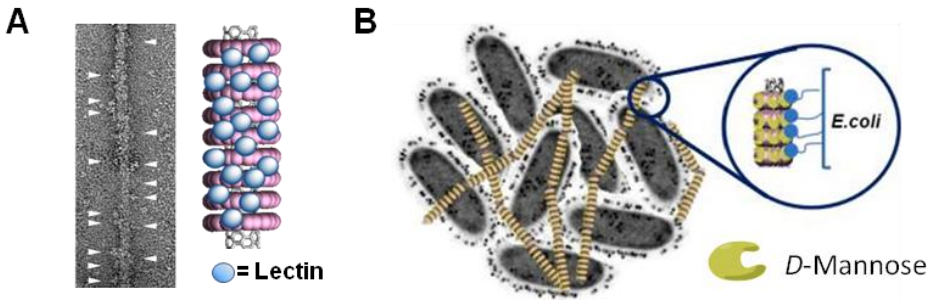

Figure 2. *Specific interaction of SWCNT/glycolipids with lectins, and application in the selective aggregation of uropathogenic bacteria.*

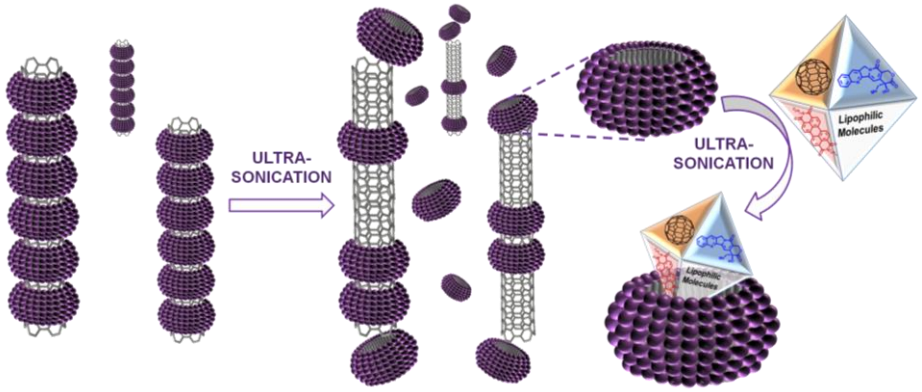

Figure 3. *Synthesis of glyconanosomes (GNSs) by the ultra-sonication-induced sliding out method and application in the water solubilization of the hydrophobic C_{60}, perylene-bisimide and the cytotoxic camptothecin (CPT).*

References

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