FUNCTIONALIZATION OF CARBON NANOTUBES FOR MATERIALS AND NANOMEDICAL APPLICATIONS

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Carbon nanotubes (CNT) have generated great expectations due to their electronic and mechanical properties. However, high molecular weights and strong hydrophobic forces keep CNT together in bundles, making their manipulation, characterization and analytical investigation very difficult. The organic functionalization offers the great advantage of producing soluble and easy-to-handle CNT. As a consequence, compatibility of CNT with other materials, such as polymers, is expected to improve. In addition, once properly functionalized, CNT become soluble in many solvents, so that their solution properties can be studied. Many functionalized carbon nanotubes may find useful applications in the field of materials science and technology, including photovoltaics. Also in medicinal chemistry carbon nanotubes are set to play an important role. Their use as drug delivery scaffolds and substrates for vaccines has already been demonstrated. CNT functionalized with bioactive moieties are particularly suited for targeted drug delivery. In fact, not only they become less toxic but also exhibit a high propensity to cross cell membranes. To this aim, several strategies have been devised to solubilize nanotubes. Among these, the most successful are: 1) the covalent functionalization of sp^2 carbons at the sidewalls with organic pendant groups and 2) the non-covalent functionalization through supramolecular interactions (e.g., π-π stacking interactions), which allows the formation of stable suspensions.

Within this contribution, we will review our most recent achievements in the field of synthesis of functionalized carbon nanotubes and their applications in materials science and medicinal chemistry. Not only can CNT function as useful components in polymer composites and photovoltaic devices, but they are excellent carriers for drug delivery and ideal substrates for neuronal growth.