New selective drugs based on carbon nanohorns

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Carbon nanohorns [1] (CNHs) are horn-shaped tubular structures (similar in structure to single-walled carbon nanotubes) capped with a conical tip. Individual nanohorns tend to cluster and form a globular structure between 80 and 100 nanometres in diameter with the tips of individual nanohorns projecting outward from the centre in all directions. The high purity and the lack of metal particles of produced CNHs is their major advantage compared to carbon nanotubes. These nanomaterials have interesting properties such as chemical and mechanical stability as well as an average size that allows their inclusion through endocytosis into the inner cell. These properties make them suitable for biomedical applications. [2] CNHs have already been used as carriers in nanomedicine but the main handicap of these systems is their lack of specificity.

CNHs have the ability to carry many molecules grafted on their sidewall due to their high surface area. This property fact makes possible the creation of new systems where an antineoplastic agent is linked to CNHs, acting as vectors, bearing at the same time a targeting antibody.

Antibodies, also known as immunoglobulines, are a family of large Y-shaped proteins produced by the immune system to identify and neutralize foreign objects in the body. They can target key regulators in the development of cancer. The antineoplastic agent used in this work has been a cisplatin derivative. Cisplatin is responsible for the cure of over 90% of testicular cancer cases and it plays a vital role in the treatment of cancers such as ovarian, head and neck cancer, bladder cancer, cervical cancer, melanoma, lymphomas, as well as several others.

Different conjugates have been synthesized such as an antibody-CNH derivative, a cisplatin CNH derivative and an antibody-cisplatin-CNH derivative. These systems have been characterized using various techniques, including UV-vis-spectroscopy (Kaiser test and Ellman test), transmission electron microscopy (TEM) and thermogravimetric analysis (TGA).

The synthetic approach will permit new modifications on the carbon nanohorns and the introduction of different antibodies and different drugs, opening the door to new studies.

References

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