Hexagonal Boron Nitride: Properties and study of its possible application in biomedicine and health

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Abstract:

After the isolation of a monolayer of graphite, graphene has attracted a lot of interest due to its remarkable properties and its potential applications in the fastest growing scientific fields. This discovery led also to the exploration of other layered nanomaterials which have similar properties with graphene and graphite and they can also complement the requirements associated with them. Boron nitride (BN) is such an example. It exists in various crystalline forms which are isoelectronic to a similarly structured carbon lattice, but the hexagonal one (h-BN),corresponding to graphite, is the most stable between its other polymorphs. This gives BN many advantages such as chemical stability and inertness, thermal conductivity, good lubricity and lots of mechanical properties [1].

A rising scientific field of the last decades is the applications of promising materials in biomedicine for their use as biological probes and in therapeutic composites. Thus, BN seems to be a key-material. Boron nitride nanotubes (BNNTs) have properties analogous to graphite, hense also to Carbon nanotubes (CNTs). However, they can be superior to CNTs in this field because they are wide band gap semiconductors whose electrical properties are independent of geometry, opposed to CNTs. Furthermore, BNNTs are more chemically inert and structurally stable [2]. This last property prompted the scientific community to investigate the interaction of BNNTs with components of the biological environment to reveal the opportunities that are offered.

In this presentation we are going to talk about highly pure BNNTs synthesized by a chemical vapor deposition (CVD) process and characterized by different kind of microscopies. Subsequently, they were cultured with different cell lines, such as human embryonic kidney (HEK 293) cells and Chinese hamster ovary (CHO) cells for about 4 days. They were tested about their cytotoxicity, the induction of apoptotic pathways in the cells and the viability of the cells. The results showed that BNNTs are noncytotoxic, do not appear to inhibit cell growth but also do not induce apoptosis to the cells. All the previous findings suggest that the general use of BN in therapeutic or diagnostic applications should be seriously considered.

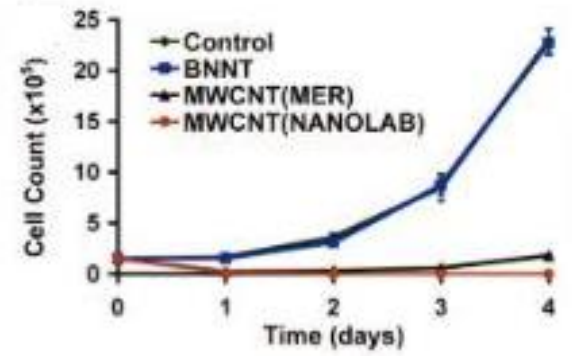

Figure 1: BNNTs are not cytotoxic [2]

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