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SYNTHESIS, CHARACTERIZATION AND BIOCOMPATIBLE PROPERTIES OF BORON NITRIDE NANOTUBES

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Introduction: Despite the progress achieved with the new therapies, cancer remains one of the biggest challenges of global health, since it is the leading cause of death in economically developed countries and the second most in developing countries. It is estimated that the mortality rate due to cancer is 20% in industrialized countries. However, in Brazil neglected diseases significantly reduce the life expectancy of cancer patients. Currently, cancer therapy involves a combination of therapies aimed at reducing tumor size (prior to surgery) or the destruction of cancer cells remaining (post-surgery). Thus, the use of multimodal therapies for cancer treatment allows obtaining greater cure rate once the disease is controlled at the microscopic level, with at the same time an increase in the patient's quality of life. In this context, a boron nitride nanotube (BNNT) appears to be a promisor material for the cancer treatment through boron neutron capture therapy (BNCT). BNCT is a radiotherapy technique that promotes a highly vectored energy deposition in tumoral cells through decay of 11B to 10B after irradiation by thermal neutrons from a nuclear reactor. Thus, due to their elevated content in 11B, BNNT appears to be a promisor material for use in BNCT therapy. The aim of this work was the synthesis and characterization of the genotoxicity property of BNNTseeking their use as carrier systemin cancer therapy by BNCT. Materials and Methods: In this study, BNNT were successfully synthesized from solid state substitution reactions between (SSSR) B2O3under a nitrogen atmosphere at 1273 K with a mixture of boron and iron oxide. Physical and structural properties of the synthesized materials were determined by X-Ray Diffraction (XRD), Energy Dispersive X-Ray Spectroscopy (EDS), Fourier Transform Infrared Spectroscopy (FTIR), thermogravimetric analysis (TGA) and Scanning Electron Microscopy. Thermogravimetric analyzes were performed using a Shimadzu TG-50 at a heating rate of 5, 10, 20 and 30°C/min from the ambient temperature to 1000°C using an alumina-sample holder and normal atmosphere. FTIR/ATR was performed on a Shimadzu IRTracer-100 model with scanning from 600 to 4000 cm-1. The XRD analysis wasconducted in a diffractometer X-ray PanalyticalX'pertPRO at 40kV and 40mA. The radiation used was CoKa (? = 1,790955Å) for angles 2? between 10° and 90° with 0.02° step scanning and measuring time of 2 s/step. The crystalline phases of BNNT were identified by Xpert High Score software. Results and Discussions: The activation energy (Ea) for the synthesis of BNNT via the SSSR was81kJ.mol-1 (Ozawa method, r2>0.99).The FTIR analysis indicates two intense absorption bands at 802 cm-1 and 1377?cm-1 characteristic of the vibrational modes of B-N and B-N-B bonds, respectively.EDS results also indicated the presence of boron nitride and the atomic ratio of boron to nitrogen was compatible with the chemical stoichiometric relation between boron and nitrogen. XRD results showed the presence of diffraction peaks at 2?=28.07º, 41,59º, 58,13º and 75,99º that can be indexed as (002), (100), (004) and (110) planes of hexagonal boron nitride structure. The cytotoxicity and genotoxicity effect of BNNT against human dermal fibroblasts (HDFs), adenocarcinoma human alveolar basal epithelial cells (A549) and osteosarcoma cell lines MG-63 cells were studied.It was observed that HDFs, A549 cells and MG-63 cells internalized the BNNT. However, BNNT were found to not cause significant viability change and DNA damage of MG-63, HDFs and A549 cells.Conclusions:In conclusion, our study suggests that BNNTs can be synthesized by SSSR and have adequate biocompatible properties for their use in BNCT as drug carrier. Based on the biological assays, it can be concluded that BNNT synthesized in this work might be good candidates for applications in oncologic medicine. Acknowledgment: Authors are very grateful to CAPES and CNPq for the financial support of this work. We also acknowledge support of the FAPEMIG for the for the financial support for participation of CBECIMAT 2016.