Design and characterization of DOX-loaded BN nanocarriers for tumor therapy

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Abstract (300 word limit)

In recent years, the development of nanoparticles (NPs) for the delivery of antitu-mor drug has received a lot of attention both from the material science and medical research communities. In this study we developed BN nanoparticles with petal-like surface as novel nanocarrier for effective antitumor drug delivery.

The BNNPs were prepared by chemical vapor deposition method using powder mixtures of FeO, MgO, and B as a precursor. The synthesised products consisted of round shape nanoparticles covered with numerous nanosheet-like petals with an average size of 100-200 nm. The formation BNNPs with a hexagonal structure was confirmed by XRD and FTIR spectros-copy.

The developed specific surface area of BNNPs allowed to load them with a high dose of doxorubicin (DOX) - up to 0.055 mg/mg of nanoparticles. Study of DOX release showed that DOX-loaded BNNPs are stable at neutral pH, whereas DOX effectively releases in acidic medium (pH 4.5–5.5), i.e. under conditions comparable to those found in endosomes/lysosomes. By means of confocal microscopy it was shown that BNNPs-DOX nanocarriers were internalized into lAR-6-1 neoplastic cells using endocytic pathways, and then DOX released from BN-carriers and accumulated both in nuclei and cytoplasma resulting in cell death. The IC50 for tumor cells was 0.005 mg/ml. BNNP-DOX conjugates were also effective against tumor cells possessing MDR, but IC50 was higher (0,095 mkg/ml).

Compared with other known nanosystems for drug delivery, BNNPs have a number of advantages: they are not toxic; have high chemical stability; particle spherical shape is optimal for uptake by tumor cells; have an optimal size of 100-150 nm for uptake by the tumor cells; and have high specific surface area. In addition, the presence of the internal cavity and hexagonal structure with a high lattice parameter are beneficial in terms of sorption capacity and effective drug release.

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Recent Publications (minimum 5)

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Biography

Irina Sukhorukova is expert in the field of biomaterials for various purposes - antibacterial coatings, nature extracellular bone scaffolds, nanostructures for drug delivery. Her work has been published in leading journals in the field of bio-material science. She is author of invention "Method of boron nitride nanoparticles fabrication for anticancer drug delivery", which were awarded awards at international exhibitions - Gold medal at the XVIII Moscow International Salon of Inventions and Innovation Technologies "Archimedes 2015"; special prize of innovation and inventive community of the Republic of China (Taiwan); silver Medal of the 26th International Exhibition of Innovation and Technology ITEX'15 (Malaysia, Kuala Lumpur); special prize of the National Research Foundation of Thailand for the best international development in the field of medicine provided to ITEX'15.

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