SYNTHESIS OF MANGANESE-DOPED MESOPOROUS SILICA NANOPOWDER FOR TARGETED DRUG DELIVERY[1]

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It is well known that conventional drugs have many disadvantages, such as poor solubility, unexpected biodistribution during the therapeutic process and a number of side effects. In recent years, the studies of nanopowder (NP) for targeted drug delivery are rapidly developing, because NP can improve many pharmacological properties of conventional drugs [1]. Protection of the drugs by NP, which can easily enter cells in targeted tissues, increases intracellular concentration of the drugs. This can reduce the quantity of drug needed to attain the particular concentration in the place of interest, and drug concentration at non-target locations in the organism.

Mesoporous silica NP is of significant interest for development of delivery systems due to its good general biocompatibility, high specific surface areas, pore size and opportunity to surface functionalization [2]. The manganese dopant can promote visualization of delivery process using MRI.

The researched manganese-doped mesoporous silica NP (SiO_2-MnO_2) with 0.1, 3, 5 % dopant concentrations have been produced by the method of electron beam evaporation in low-pressure gas (4 Pa) on NANOBIM-2 installation. The target was made of silica NP (Aerosil 90) and manganese dioxide powder (GOST 4470-79). NP was deposited on large-surface glass noncooled substrates in the powder collection chamber to prevent the crystallizer material from being absorbed into the NP [3].

According to BET analysis, produced SiO_2-MnO_2 NP are highly porous with high pore volume (average size and pore volume of 22.6 nm and 0.76 cm^3 /g, respectively, the specific surface area increases with the increasing in dopant concentration from 75.78 to 176.35 m^2 /g).

Transmission microscopy of NP demonstrates porous agglomerates of NP, with a disordered hollow structure. The NP with such hollow structure must be particularly noteworthy in drug delivery systems because they also can efficiently accommodate drugs into the hollow interiors [1].

Cytotoxicity experiments on cells showed that NP exerted low toxicity.

For loading experiments anti-inflammatory drug Amoxicillin and chemotherapy drug Doxorubicin was chosen. The loading was achieved by soaking the NP in a solution of the drug to allow adsorption interactions between the drug and the particle surface. These interactions usually involve hydrogen bonding and electrostatic attractions [4]. After sonication the NP suspension was stirring during 24 h. The loaded NP was separated by centrifugation (10 000 rpm, 10 min) and washed once with water. The supernatant and NP were collected. The release of drug from NP was determined by suspending of loaded NP in deionized water. The loading degree of drug was determined by spectroscopy.

Thus, produced SiO_2-MnO_2 mesoporous NP is a perspective material for pharmaceutical applications especially for the targeted drug delivery systems.

REFERENCES

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