Nanocomposites and nanomaterials

Synthesis and examination of nanocomposites based on poly(2-hydroxyethyl methacrylate) for medicinal use

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Hydrogel therapy systems which support prolonged release of bioactive substances and drugs is a modern trend in manufacturing of surgical coatings, implants, catheters, drainages etc. For this purpose, biocompatible swelling poly(2-hydroxyethyl methacrylate) (PHEMA) is widely used.

To manage the drug release, the different composite materials based on PHEMA matrix were synthesized in this work. Thermal polymerization was initiated by azobisisobutyronitrile and triethylene glycol dimethacrylate was used as a crosslinking agent. Some of obtained composites were filled by nanosized silica with immobilized on its surface drugs and bioactive substances, to others any amounts of water for pore formation were added. Part of composites were synthesized on the basis of polyurethane/PHEMA semi-interpenetrating polymer network [1]. The substances incorporated into the mentioned above materials were metronidazole, decamethoxin, silver nitrate, zinc sulfate, glycine and tryptophan.

The interaction between nanosilica filler and polymer matrix was examined by IR spectroscopy. Thermal properties and stabilities of nanocomposites have been studied by TGA/DTA analysis. The porous structure of materials after swelling was observed by high magnification optical microscopy and SEM. The release kinetics of substances and a rate of swelling of nanocomposites were investigated by absorption spectrophotometry and chemical methods. The antimicrobial properties, general toxic effect and reaction of the surrounding tissues after implantation of nanocomposites to test animals were also examined.

As a result of research the factors that allow to regulate the release kinetics of bioactive substances from nanocomposites on the basis of PHEMA matrix were established.

1. *L.V. Karabanova, Yu.P. Gomza, S.D. Nesin, O.N. Bondaruk, I.I. Gerashchenko, E.F. Voronin, L.V. Nosach, V.I. Zarko and E.M. Pakhlov*, in: A.G. Naumovets (Ed), Nanosized Systems and Nanomaterials: Investigations in Ukraine, AcademPress: Kiev, 2014, p. 724.