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Polymer Composites Containing Gold Nanoparticles for Biomedical Use

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Abstract : Introduction: Nanomaterials become one of the leading materials in the synthesis of various compounds. This is a reason for the fact that nano-size materials exhibit other properties compared to their macroscopic equivalents. Such a change in size is reflected in a change in optical, electric or mechanical properties. Among nanomaterials, particular attention is currently directed into gold nanoparticles. They find application in a wide range of areas including cosmetology or pharmacy. Additionally, nanogold may be a component of modern wound dressings, which antibacterial activity is beneficial in the viewpoint of the wound healing process. Specific properties of this type of nanomaterials result in the fact that they may also be applied in cancer treatment. Studies on the development of new techniques of the delivery of drugs are currently an important research subject of many scientists. This is due to the fact that along with the development of such fields of science as medicine or pharmacy, the need for better and more effective methods of administering drugs is constantly growing. The solution may be the use of drug carriers. These are materials that combine with the active substance and lead it directly to the desired place. A role of such a carrier may be played by gold nanoparticles that are able to covalently bond with many organic substances. This allows the combination of nanoparticles with active substances. Therefore gold nanoparticles are widely used in the preparation of nanocomposites that may be used for medical purposes with special emphasis on drug delivery. Methodology: As part of the presented research, synthesis of composites was carried out. The mentioned composites consisted of the polymer matrix and gold nanoparticles that were introduced into the polymer network. The synthesis was conducted with the use of a crosslinking agent, and photoinitiator and the materials were obtained by means of the photopolymerization process. Next, incubation studies were conducted using selected liquids that simulated fluids are occurring in the human body. The study allows determining the biocompatibility of the tested composites in relation to selected environments. Next, the chemical structure of the composites was characterized as well as their sorption properties. Conclusions: Conducted research allowed for the preliminary characterization of prepared polymer composites containing gold nanoparticles in the viewpoint of their application for biomedical use. Tested materials were characterized by biocompatibility in tested environments. What is more, synthesized composites exhibited relatively high swelling capacity that is essential in the viewpoint of their potential application as drug carriers. During such an application, composite swells and at the same time releases from its interior introduced active substance; therefore, it is important to check the swelling ability of such material. Acknowledgements: The authors would like to thank The National Science Centre (Grant no: UMO - 2016/21/D/ST8/01697) for providing financial support to this project. This paper is based upon work from COST Action (CA18113), supported by COST (European Cooperation in Science and Technology).

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