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Radiation Synthesis of Polymer Nanogels for Biomedical Applications

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One of the most rapidly developing fields of nanotechnology is nanomedicine. Creation of nanoscale materials which could be transported via the cardiovascular system, penetrate cellular membranes and selectively target specific tissues or organs opens a new range of possibilities for controlled drug delivery, gene therapy, radiotherapy, etc. Important class of nanoparticles for medicine are nanogels.
Nanogels can be defined either as tiny fragments of hydrogel networks, or as internally cross-linked single macromolecules. Classical polymer chemistry offers several ways to synthesize polymer nanoparticles, but most of them require complex procedures and the use of monomers, cross-linking agents, initiators, surfactants, which are difficult to remove from the final product, while some of them may be toxic. Since late 1990' s an alternative approach based on radiation chemistry has been proposed and developed, where the only substrates are polymer chains and solvent (usually water). The basic idea of this technique is to irradiate a dilute polymer solution in such a way that many radicals are present simultaneously on each macromolecule. Their intramolecular recombination creates new covalent bonds linking the segments of the polymer chain and thus a nanogel particle is formed. Understanding the mechanism and kinetics of these processes can be facilitated by using pulse radiolysis and Monte Carlo simulations. Procedures have been developed to synthesize nanogels having their mass and size tailored to meet specific needs.
This talk, besides presenting the basics of radiation synthesis of nanogels and recent developments from authors'lab, is also intended to briefly summarize important progress in this field achieved by teams from many countries. Co-operation between these research groups has been greatly facilitated by a number of recent CRPs on these topics, initiated and co-ordinated by IAEA.

Country/Organization invited to participate

Poland

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