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Influence of Ionizing Radiation on Hydrophilic Polymers Irradiated In Solid State and Aqueous Solutions

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Radiation is an effective and established tool to sterilize medical and healthcare products including a wide range of single-use medical products and devices. Sterilization is mostly done using gamma sources, however a transition to accelerator-based sterilization is being observed. Lack of the knowledge of radiation effects on polymers for electron beam is one of the reasons to impede the spreading use of these technologies.

Increasing need of the knowledge of sterilization or re-sterilization of medical devices is the other reason to continue a detailed research study on influence of ionizing radiation on polymer-based products used in medicine.

The purpose of this work is to expand our understanding of radiation effects on selected polymers and polymeric materials commonly used in medical devices by comparing gamma and electron beam irradiation. The analyzed polymers were: poly(ethylene oxide), poly(N-vinyl-2-pyrrolidone) and poly(acrylic acid). Basic physico-chemical properties of unirradiated material have been examined with the use of static- and dynamic light scattering as well with gel permeation chromatography (triple detection: multiangle light scattering, refractive index and viscosity have been used to obtain absolute values). The next stage of studies was devoted to comparison of effect of irradiation on selected polymers with three different dose rates (gamma and electron beam irradiation), both in a solid state and in aqueous solution. In case of irradiation in the solution saturation with inert gas (argon) has been also analyzed.