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Biocompatible Hydrogel Materials Containing Cytostatics for Cancer Treatment

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Abstract : Recently, the continuous development of medicine and related sciences has been observed. Particular emphasis is directed on the development of biomaterials, i.e., non-toxic, biocompatible and biodegradable materials that may improve the effectiveness of treatment as well as the comfort of patients. This is particularly important in the case of cancer treatment. Currently, there are many methods of cancer treatment based primarily on chemotherapy and the surgical removal of the tumor, but it is worth noting that these therapies also cause many side effects. Among women, the most common cancer is breast cancer. It may be completely cured, but the consequence of treatment is partial or complete breast mastectomy and radiation therapy, which results in severe skin burns. The skin of the patient after radiation therapy is very burned, and therefore requires intensive care and high frequency of dressing changes. The traditional dressing adheres to the burn wounds and does not absorb adequate amount of exudate from injuries and the patient is forced to change the dressing every 2 hours. Therefore, the main purpose was to develop an innovative combination of dressing material with drug carriers that may be used in anti-cancer therapy. The innovation of this solution is the combination of these two products into one system, i.e., a transdermal system with the possibility of a controlled release of the drug- cytostatic. Besides, the possibility of modifying the hydrogel matrix with aloe vera juice provides this material with new features favorable from the point of view of healing processes of burn wounds resulting from the radiation therapy. In this study, hydrogel materials containing protein spheres with the active substance have been obtained as a result of photopolymerization process. The reaction mixture consisting of the protein (albumin) spheres incorporated with cytostatic, chitosan, adequate crosslinking agent and photoinitiator has been subjected to the UV radiation for 2 minutes. Prepared materials have been subjected to the numerous studies including the analysis of cytotoxicity using murine fibroblasts L929. Analysis was conducted based on the mitochondrial activity test (MTT reduction assay) which involves the determining the number of cells characterized by proper metabolism. Hydrogel materials obtained using different amount of crosslinking agents have been subjected to the cytotoxicity analysis. According to the standards, tested material is defined as cytotoxic when the viability of cells after 24 h incubation with this material is lower than 70%. In the research, hydrogel polymer materials containing protein spheres incorporated with the active substance, i.e. a cytostatic, have been developed. Such a dressing may support the treatment of cancer due to the content of the anti-cancer drug - cytostatic, and may also provide a soothing effect on the healing of the burn wounds resulted from the radiation therapy due to the content of aloe vera juice in the hydrogel matrix. Based on the conducted cytotoxicity studies, it may be concluded that the obtained materials do not adversely affect the tested cell lines, therefore they can be subjected to more advanced analyzes.

Keywords : hydrogel polymers, cytostatics, drug carriers, cytotoxicity
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