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SYNTHESIS AND CHARACTERIZATION OF NEW HYDROGEL MATERIALS BASED ON ACRYLIC MONOMERS FOR DRUG DELIVERY

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Introduction: Delivery of drugs to the target organ or even to the target cell appears to be one of the central problems in pharmacology and medicine. Nowadays mucoadhesion is accepted as a promising strategy for prolongation of drug residence time and improvement of specific localization for drug delivery systems on various membranes^[1-2]. We assume that our thiolated materials will provide better mucoadhesion capability due to complementary bond formation between mucosa and material^[3].

Nanoparticles based on 3-mercaptopropyltrimethoxysilane (3-MPTS) were synthesized following the method described in^[4]. The yield and concentration of these nanoparticles were determined.

Materials and methods: Thiolated hydrogels based on 2-hydroxyethylmetacrylate (HEMA) and 2-hydroxyethylacrylate (HEA) copolymers structured with 3-MPTS nanoparticles of different composition have been synthesized by free radical polymerization. Obtained crosslinked copolymers have been characterized by FTIR-spectroscopy and iodometry for confirmation of thiolation of obtained copolymers. Concentration of thiolated samples laid in concentration range 12-46 $\mu\text{mole per g}$ polymer. Size and size distribution of nanoparticles in polymer matrix were investigated by small angle X-ray scattering spectroscopy and scanning electron microscopy. Average size of nanoparticles incorporated in polymer network was about 60-70 nm. Mechanical properties of resulting materials were investigated by compression test. Thiolation of hydrogels resulted in increasing of their mechanical properties.

Retention time of copolymer hydrogels on mucosal surfaces was evaluated by “falling liquid method”. It was revealed that increase in concentration of hydrophilic component, nanoparticles content and crosslinking agent concentration reflects in an increase of adhesion time of obtained hydrogel materials.

Results: Synthesized hydrogels were estimated as a drug delivery system. The metronidazole was loaded into obtained thiolated hydrogels by simple absorption method. Drug loading and drug release studies with metronidazole were conducted. It was observed that thiolated samples absorb more drug than non-thiolated ones. As nanoparticles concentration increases metronidazole content rises respectively.

Drug release studies revealed that the higher concentration of 3-MPTS nanoparticles in hydrogels results in prolongation of drug release but concentration of discharged metronidazole decreases. When hydrophilic component in copolymer content increases the concentration and rate of released metronidazole also growing.

The chemical modification of mucoadhesive polymers via addition of various reagents bearing sulfhydryl functional groups leads to broadening of their application possibilities. As a result of this research new thiolated polymers with improved mucoadhesive properties will be provided. The practical significance of the work is to obtain hydrogel materials for drug delivery, particularly as a buccal dosage form.

References:

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