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FABRICATION OF DRUG DELIVERY SYSTEM BASED ON TiO_2 NANOTUBES WITH HYDROXYAPATITE

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Controllable release of substances in surrounding is highly relevant these days. The titania nanotubes are high resistant and inert material. In this regard, modificated surface with nanotubes provides a platform for substance loading and remains stable while the substance release. Modification of TiO_2 surface with hydroxyapatite provides a method of controllable release and subjects a way of drug delivery with changing velocity.

The approach that was used in the research, incudes three steps: modification of TiO_2 nanotubes with hydroxyapatite, loading dye in TiO_2 nanotubes and release of dye. First stage includes twenty cycles. During the cycle, the sample was immersed in $CaCl_2$ for 1 min and then in 0.02 M Na_2HPO_4 for 1 min. The hydroxyapatite was deposited in the pores via reaction between 0.02 M $CaCl_2$ and 0.02 M Na_2HPO_4 in alkali medium (pH = 8). After modification of TiO_2 nanotubes with HA, the loading of model substance was done. The dye was used as a model substance to study an opportunity how drugs could be loaded in the TiO_2 pores, and to reveal the kind of interactions between dye and samples. The release kinetics was studied using titania layer as a reference. The process of dye loading for both types of the samples was the same. The last step is the release of dye from TiO_2 nanotubes. There is a rapid release of Rhodamine 6G during the first 20 min, then there is a noticeable speed fall for HA-modified sample compared to a reference sample. The concentration of the loaded dye was the same for the TiO_2 and HA-TiO_2. It means that the amount of loaded dye was over the limit of HA absorption possibility, but HA prevents the continuing release of substance the way it was before and causes the fall in speed. Almost at the very beginning of the release, both graphics start divers gradually. The release of acridine orange for both samples does not include rapid increases and falls at speed. For acridine orange, the initial loaded amount was exactly the limit that could be loaded in HA. The continuations of releases show that HA inserts a constant to release that does not fluctuate rapidly during the release. In the end, both graphics reach a plateau. After studying the model dye molecules, the antibiotic was used. Tetracycline releases from HA-TiO_2 slowly due to HA presence.

Hydroxyapatite causes delayed release of tetracycline until the definite moment after which both releases reach the same speed within error and limit to plateau. It shows that HA forms a complex that collapses after an extended time being in the solvent. Loading hydroxyapatite into TiO_2 nanotubes as a modification for following loading of substance provides an opportunity to prevent promote and fast release of a substance in the surrounding.

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