The abstract of doctoral dissertation

„Conjugated polymers as matrices in controlled delivery of biologically active compounds"

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This work is a summary of the research on the application of conjugated polymers as carriers for selected biologically active compounds. It consists of the description of the studies on the optimization of procedures to obtain drug-loaded conjugated polymer matrices, as well as it provides the set of conditions to enable controlled drug delivery. Polypyrrole, poly(3,4-ethylenedioxythiophene) and poly(3,4-ethylenedioxypyrrole) served as conjugated polymer matrices, and the model biologically active compounds were selected among anti-inflammatory drugs (ibuprofen, quercetin), antibiotics (ciprofloxacin) and anti-cancer agents (oleanolic acid, disuccinyl derivative of betulin).

Two methods of drug immobilization were described and compared. The one-step method was efficient for the immobilization of non-ionic biologically active compounds, as a result of the entrapment process. The three-step process was more efficient for the immobilization of ionic drugs with active anion. The separation of matrix formation and drug immobilization processes, just as it is described for three-step method, allows one matrix to be loaded with drug molecules multiple times.

The results provided with Raman spectroscopy and EDX analysis proved the presence of drug molecules on the surface of synthesized matrices, as well as the fact that as a result of electrochemical processes the surface becomes drug-depleted and drug molecules are efficiently released to the solution. SEM analysis showed that the morphology of matrix surface is influenced by the choice of immobilization method and immobilized molecules. The drug-loading efficiency is dependent on the matrix's thickness and the concentration of drug used during its immobilization.

The release of drugs from conjugated polymer matrices relied on three processes, i.e. passive release, active release with constant potential – potentiostatic mode and active release with potential sweep – potentiodynamic mode. It was shown that both active release methods

allow to control the amount of released drug through the proper selection of time of the release process, number of CV cycles or range of potentials.

The biological measurements based on the determination of viability of selected cancer cell lines (HeLa, KB and A-549) proved that conjugated polymer matrices are advantageous materials for chemotherapy purposes. It was shown that the electrochemical processes of drug immobilization and release did not affect the anti-cancer activity of a model anti-cancer agent, oleanolic acid.

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