Abstract

This dissertation presents research that was performed to characterize the properties of hydrogel polyurethane nanocomposites for potential use as dressings that additionally release analgesic active substances.

The main purpose of the research work was to conduct studies on the absorption and release of active substances from hydrogel matrices and nanocomposites. Release studies were combined with solvatochromic studies to explain the difference in the release process of naproxen sodium and paracetamol. The experimental studies were supplemented with a description using theoretical models.

The research material were hydrogel polymer nanocomposites with different content of flexible segments in the matrix and different content of nanoparticles in the form of Cloisite® 30B (sodium montmorillonite modified with a quaternary amine salt). Studies of the release process were carried out for two active substances: naproxen sodium and paracetamol and related substances: acetanilide and ethylaniline.

Experimental studies of absorption and release processes were performed using gravimetric and spectroscopic techniques (stationary absorption and fluorescence spectroscopy in the UV–Vis range). Material characterstics were carried out using X–ray diffraction technique (to determine the distribution of nanoparticles in the matrix) and by thermoporometry using differential scanning calorimetry (to determine the size of the pores in the matrix). The active substances were characterized by solvatochromic methods using spectroscopic techniques to determine the potential of drug interaction with the matrix. The kinetics of absorption and release of active substances has been described in accordance with the theory described by Peppas, Langer, Korsmeyer, Berens and Hopfenberg.

The research allowed observation of *nano effect* – the beneficial effect of the presence of nanoparticles on the properties of the material, both in the case of absorption (increasing absorption capacity) and release (controlled distribution of the drug in nanocomposites).

An important achievement of the work is a new approach to analyzing the phenomenon of release as opposed to commonly used methods. The possibility of potential interaction of the active substance with the matrix and the effect of this phenomenon on the kinetics of release of active substances were investigated.