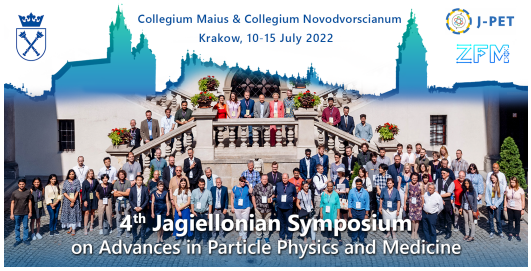

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Polymer and composite carriers for controlled drug release

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Delivering of the active pharmaceutical ingredients (APIs) to the organism in the desired manner is a great challenge. Therefore, it is important to develop and investigate new systems, allowing to control both the rate and the period of drug delivery. In such systems, the carrier, in which API is dissolved, can and should be designed and/or modified in a way which allows to control the infiltration of the dissolution medium into the system, resulting in a modification of API release. The porous matrices seem to be suitable carriers for this purpose, as a solid dispersion of the drug can be formed inside of them.
Several solid API dispersions have been developed with diclofenac sodium as API and porous carriers such as mesoporous polymers: poly(trimethylolpropane trimethacrylate) (poly(TRIM)), and commercially available Amberlite® XAD7HP as well as polymer-silica composites [1]. Additionally, selected carriers were modified by functionalizing with 3-aminopropyl groups or tableting by mechanical compression.
The rate of the diclofenac sodium release from each of solid dispersions was examined in vitro to assess their usefulness for the controlled release. The use of XAD7HP with small amount of API and poly(TRIM) functionalized with 3-aminopropyl groups as porous carriers gave satisfying results, with the drug release profile quite close to linear, Unfortunately, good release profiles were obtained at the expense of reducing the amount of released API from nearly 100% to about 50% after 24 hours. It is also worth to mention, that increasing the amount of diclofenac sodium added into XAD7HP caused nonhomogeneous distribution of API inside a carrier and gave non-satisfying results in the release profile.
To better understand the course of the drug release, the initial distribution of diclofenac sodium within the carrier for each solid dispersions as well as the distribution of remaining diclofenac sodium after various release times for selected samples were studied. The morphology and the spatial distribution of the elements in sample cross-sections were determined with scanning electron microscopy (SEM) coupled with energy dispersive spectroscopy (EDS). The porosity of the investigated systems was characterized with classic low-temperature N2 adsorption porosimetry and positron porosimetry based on positron annihilation lifetime spectroscopy (PALS).

[1] A. Kierys, R. Zaleski, M. Grochowicz, M. Gorgol and A. Sienkiewicz, Micropor Mesopor Mat, 294, 109881 (2020).

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