Controlled drug release monitored by PALS

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Development of new controlled drug release systems for oral application is constantly a topic of interest. The solubility of active pharmaceutical ingredients (APIs) in an aqueous environment is one of the most important factors determining the selection of a strategy to control their release. In the case of water-soluble medicines, the most effective approach is to control the infiltration of the dissolution medium. This can be done by dispersing API in a porous matrix, which results in the formation of a solid dispersion of the drug within the carrier. *In vitro* examination of the API release rate from the solid dispersion to the dissolution medium allows to assess usefulness of the system as the controlled release one [1].
To better understand the course of the drug release positron annihilation lifetime spectroscopy (PALS) was used for the study of the solid dispersion at various stages of the release (Fig.1). On the basis of obtained results, it can be assessed how the microstructure of the carrier-drug system influences properties of the controlled drug release system. Structure examination using PALS was supported with N_2 adsorption and SEM/EDS studies. They allow to determine the parameters characterizing the porous structure as well as the morphology and the spatial distribution of the elements in an examined sample cross-section. A perspective study using positron microbeam seems to allow complementing the SEM/EDS results by position-sensitive PALS and extend information obtained with this technique.

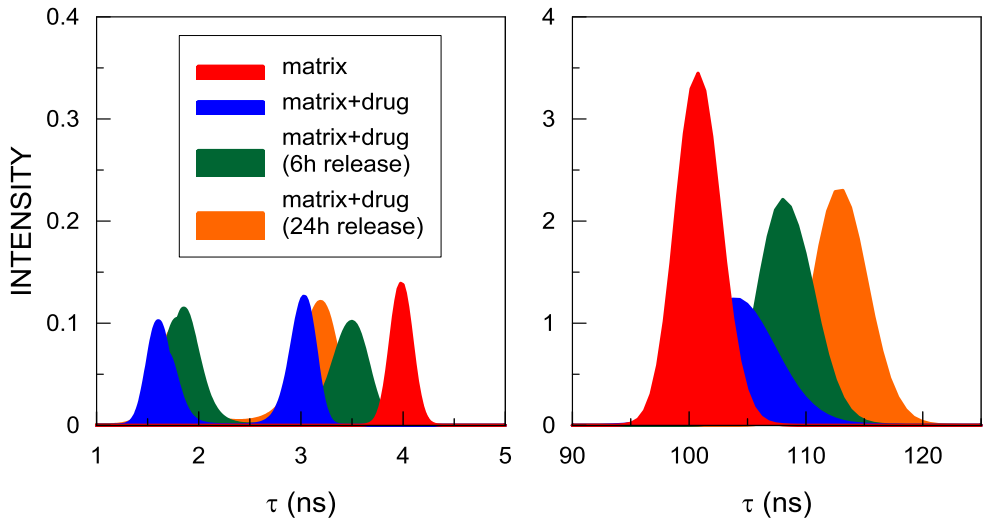

Figure 1 *Ortho-positronium components related to the drug (short-lived) and mesopores (long-lived) in the porous matrix and the matrix-drug composite at various stages of drug release.*

References

[1] A. Kierys, A. Sienkiewicz, M. Grochowicz, R. Kasperek, *Mater. Sci. Eng. C* **85** 114-122 (2018).

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