Free volume changes in the swelling process of vegetable oil-based UV-cured polymers

David Pavel Královič[1,2,*], Ondrej Šauša[1,2], Helena Švajdlenková[3], Pavol Kalinay[1], Taras Kavetskyy[4,5], Migle Lebedevaite[6], Sigita Grauzeliene[6], Jolita Ostrauskaite[6]

[1]*Institute of Physics SAS, Dúbravská cesta 9, 845 11 Bratislava, Slovak Republic*
[2] *Department of Nuclear Chemistry, Faculty of Natural Sciences, Comenius University, Mlynska Dolina, Ilkovicova 6, 84215 Bratislava, Slovakia*
[3]*Polymer Institute SAS, Dúbravská cesta 9, 845 41 Bratislava, Slovak Republic*
[4]*Department of Biology and Chemistry, Drohobych Ivan Franko State Pedagogical University, 82100 Drohobych, Ukraine*
[5] *Department of Surface Engineering, The John Paul II Catholic University of Lublin, 20-950 Lublin, Poland*
[6]*Department of Polymer Chemistry and Technology, Kaunas University of Technology, 50254 Kaunas, Lithuania*

[*]email: david.kralovic1996@gmail.com

Investigation of free-volume properties of polymer matrices based on natural oils, which are intended for the construction of amperometric biosensors, allows a better understanding of the relationship between the crosslink density of matrices, i.e. microscopic characteristics, and the main operational parameters of biosensors. The basic annihilation characteristics of the four selected polymers were determined, i.e linseed oil-based (ELO/PI, ELO/10RD1/PI) and soybean oil-based (AESO/VDM, AESO/VDM/DMPA) samples [1-3], depending on the water content in them. The swelling of these samples in water at atmospheric pressure and 296 °K was characterized by the time course of the weight of the samples. Using the known weight of water in the sample, the time course of the free volume fraction in the process of swelling of the samples in water at RT and normal pressure was reconstructed. The water content in the saturated state was dependent on the composition of the sample, but in the case of AESO / VDM / DMPA no saturation occurred and a gradual degradation of the network by the action of water is expected.
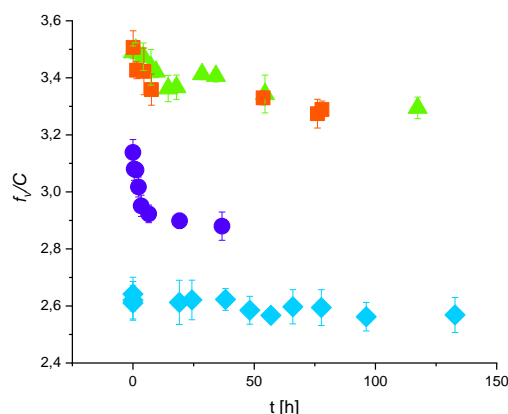
Fig.1. Reduced free volume fraction f_v/C for four investigated samples: AESO/VDM (circles); ELO/PI (triangles); AESO/VDM/DMPA (rhombuses) and ELO/10RD1/PI (squares) as a function of time at swelling in water (reconstructed).

[1] A. Remeikyte, J. Ostrauskaite, *J. Appl. Polym. Sci.*, **129**, 1290 (2013)

[2] M. Lebedevaite, J. Ostrauskaite, Skliutas, E., *Polymers* **11***, 116 (2019)

[3] M. Lebedevaite, J. Ostrauskaite, Skliutas, *J. Appl. Polym. Sci.,* **137**, 48708 (2020)