diffusion-fundamentals.org

The Open-Access Journal for the Basic Principles of Diffusion Theory, Experiment and Application

Synergy of Time-Resolved NUS and DOSY for the monitoring of photopolymerization of anthracene derivatives

Kristina Kristinaityte[1], Adam Mames, Mariusz Pietrzak[1], Tomasz Ratajczyk[1] and Mateusz Urbańczyk*[1]

[1]Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland

*murbanczyk@ichf.edu.pl

Currently, photochemistry is experiencing an upswing. This is due to the material sciences and green energy industries' interest in the practical applications of photoactive materials. The photopolymerization of anthracene derivatives is of pivotal interest as functional photoresponsive polymers can be obtained. Unfortunately, the monitoring of photopolymerization is not an easy task, as the composition of the sample changes during the photochemical processes, and the analysis of post-photoreaction products can only indirectly give information about photoreaction. Therefore, comprehensive monitoring has to be carried out in real-time mode.

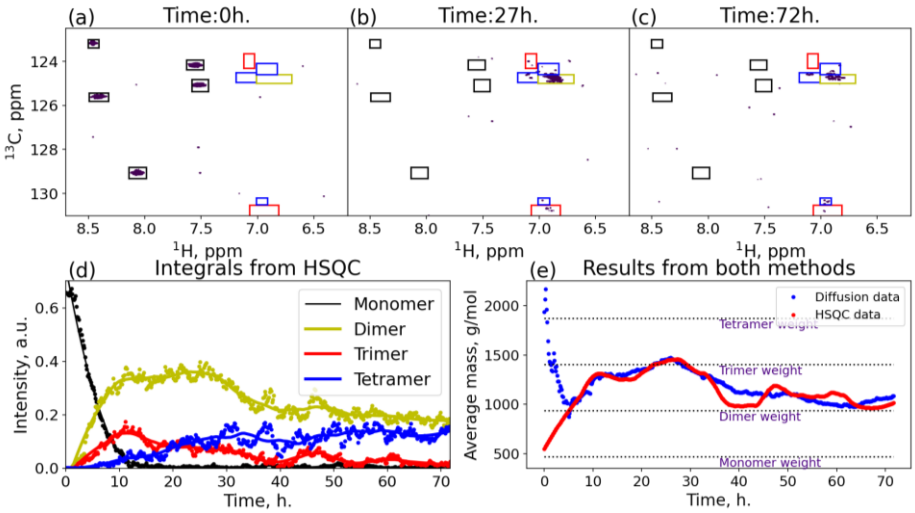

Figure 1: (a)-(c) HSQC spectra at different reaction times. Squares indicate the analyzed peaks. Colors indicate the specific n-mers as in (d); (e): Integrals calculated for the peaks for different n-mers; (e): The average mass of the mixture calculated from Diffusion and HSQC data.

Here, it is demonstrated that comprehensive monitoring of photopolymerization can be achieved through simultaneous time-resolved DOSY [1, 2] interleaved by time-resolved non-uniform sampling (TR-NUS) [3]. TR-DOSY enabled us to follow the change of the mass of a polymer as time progressed, which can be correlated with the TR-NUS HSQC spectra. Thanks to this, we observed step-by-step the creation and consumption of specific n-mers. The presented approach can significantly improve the methodology of the investigation of various photoreaction processes -in particular, photopolymerization.

References

[1] Urbańczyk, M., Bernin, D., Czuroń, A., & Kazimierczuk, K. *Monitoring polydispersity by NMR diffusometry with tailored norm regularisation and moving-frame processing*. Analyst, **141(5)**, 1745–1752 (2016)

[2] MacDonald, T. S. C., Price, W. S., & Beves, J. E. *Time-Resolved Diffusion NMR Measurements for Transient Processes*. ChemPhysChem, **20(7)**, 926–930 (2019)

[3] Mayzel, M., Rosenlöw, J., Isaksson, L., & Orekhov, V. Y. *Time-resolved multidimensional NMR with non-uniform sampling.* Journal of Biomolecular NMR, **58(2)**, 129–139 (2014).