METHOD FOR REAL-TIME MONITORING OF PHOTOPOLYMERIZATION PROCESSES OF BIO-BASED MONOMERS FROM RENEWABLE RESOURCES BY USING FLUORESCENT MOLECULAR PROBES

Patrycja Środa[a], Mariusz Galek[b], Joanna Ortyl[a,b]

[a] Faculty of Chemical Engineering and Technology, Cracow University of Technology, Warszawska 24, 31-155 Cracow, Poland
[b] Photo HiTech Ltd., Life Science Park, Bobrzyńskiego 14, 30-348 Cracow, Poland

The application of monomers of natural origin for photopolymerization processes makes it possible to obtain polymeric coatings used in many industry branches. Therefore, there is a growing interest in them as an alternative option to monomers of petrochemical origin. A very positive feature of monomers of natural origin is their biodegradability. Thanks to the possibility of the biodegradation process, the resulting polymers do not cause pollution. There is no need for long-term storage in landfills because they are broken down by living organisms into simple inorganic compounds that plants then assimilate.

Photopolymerization reactions are usually very fast, and therefore equally fast measuring methods are required to monitor these reactions. These can include FPT (Fluorescence Probe Technology). This method involves measuring changes in a probe's fluorescence properties as the properties of the environment surrounding the probe change. The FPT method provides a fast way to collect and process the collected data due to the fluorescence probe's response, the rate of which is on the order of nanoseconds. This technique allows the kinetics of the reaction to be determined. A complementary method to it can be Fourier Transform Infrared Spectroscopy, which, by measuring vibrations characteristic of a given functional group, allows the determination of monomer conversion.

In this work, the application of FPT and real-time FT-IR techniques to monitor the course of photopolymerization in the UV-VIS light range of monomers of natural origin: limonene oxide and α-pinene oxide was studied. The possibility of applying the above research methods to measure the kinetics of the reaction and the degree of monomer over-reaction was confirmed.

Acknowledgements: The authors are grateful to the Foundation for Polish Science (Warsaw, Poland) – Project TEAM TECH (Contract No. POIR.04.04.00-00-204B/16-00 – TEAM TECH/2016-2/15 – "Molecular design, synthesis and application of photoinitiator – catalysts (PICs) for photopolymerization reactions") for financial support of the FPT research.