MODIFICATION OF NON-POLAR POLYMERS WITH CARBOHYDRATES: ACCESS THROUGH MALEIC ANHYDRIDE

Jakub Lagiewka, Iwona Zawierucha

Institute of Chemistry, Faculty of Science and Technology,
Jan Dlugosz University in Czestochowa, Czestochowa 42-200, Poland
jakub.lagiewka@doktorant.ujd.edu.pl

Non-polar polymers are a class of resistant molecules which do not undergo many chemical reactions, e.g., polyethylene, poly(iso)propylene. Their molecular structure allows for a narrow range of modifications, which limits the number of applications. Thus, the presence of maleic anhydride in their structure could provide a perfect target for chemical modification. In particular, carbohydrates seem to be perfect modifiers for anhydride rings due to forming reactive alkoxides/oxyanions in different conditions, e.g., solvents (DMF, DMSO), deprotonating agents (K_2CO_3, NaH, LiH) [1]. In addition, the application of different carbohydrates based on size and chemical character could provide tailor-made properties in a wide range of technologies. Our previous studies indicated cyclodextrin oxyanions as efficient reagents for chemically resistant dianhydrides based on biphenyl [2] or perylene [3]. Thus, the aim of our research is to evaluate carbohydrates as chemical modifiers for non-polar polymers containing maleic anhydride. Herein, we have applied carbohydrates (e.g., glucose, lactose, cyclodextrin, cellulose) for the modification of non-polar polymers which were copolymers or grafted with maleic anhydride e.g. poly(ethylene-alt-maleic anhydride), polypropylene-graft-maleic anhydride. The reactions were carried out under mild conditions in dry DMF with a strong base as NaH. Depending on the conditions and the polymers, the cross-linking or grafting resulted depending on stoichiometry of carbohydrates and a deprotonating agent. The molecular structure was confirmed with spectral methods like NMR, FT-IR and chromatographic methods like GPC-SEC. Based on the results, we believe that the modified polymers with carbohydrates are promising tools for drug delivery and environmental protection.

Acknowledgements: This project is funded by „Regional Excellence Initiative" project no. RID/SP/0035/2024/01 as Microgrant no. RID_MG/1/2025.

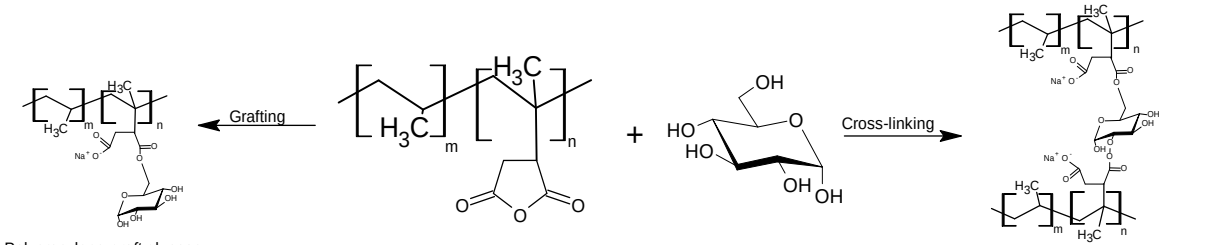

Figure 1. Reaction ways of polypropylene-*graft*-maleic anhydride with glucose.

References:
1. E. Renard, A. Deratani, G. Volet, B. Sebille., *Eur. Polym. J.* **1997**, *33*, 49-57.
2. J. Lagiewka, A. Nowik-Zajac, A. Pajdak, I. Zawierucha, *Carbohydr. Polym.* **2023**, *307*, 120615.
3. J. Lagiewka, A. Pajdak, I. Zawierucha, *Carbohydr. Polym.* **2025**, *353*, 123297.