

SYNTHESIS AND CHARACTERIZATION OF CROSS-LINKED COPOLYMERS BASED ON DEXTRIN AND POLY(N-ISOPROPYLACRYLAMIDE)

Emilija Morkvėnaitė¹, Miglė Savickė¹, Dovilė Liudvinavičiūtė¹, Ramunė Rutkaitė¹

¹Department of Polymer Chemistry and Technology, Kaunas University of Technology, Lithuania
emilija.morkvenaite@ktu.edu

Thermo-responsive polymers have gained significant attention due to their ability to undergo reversible phase transitions in response to temperature changes. These materials are widely explored in biomedical applications, particularly drug delivery, tissue engineering, and stimuli-responsive systems. However, developing effective thermo-responsive polymeric matrices with controlled swelling and phase transition behavior remains a challenge [1]. This study addresses this gap by synthesizing and characterizing cross-linked dextrin-based copolymers with tunable thermo-responsive properties.

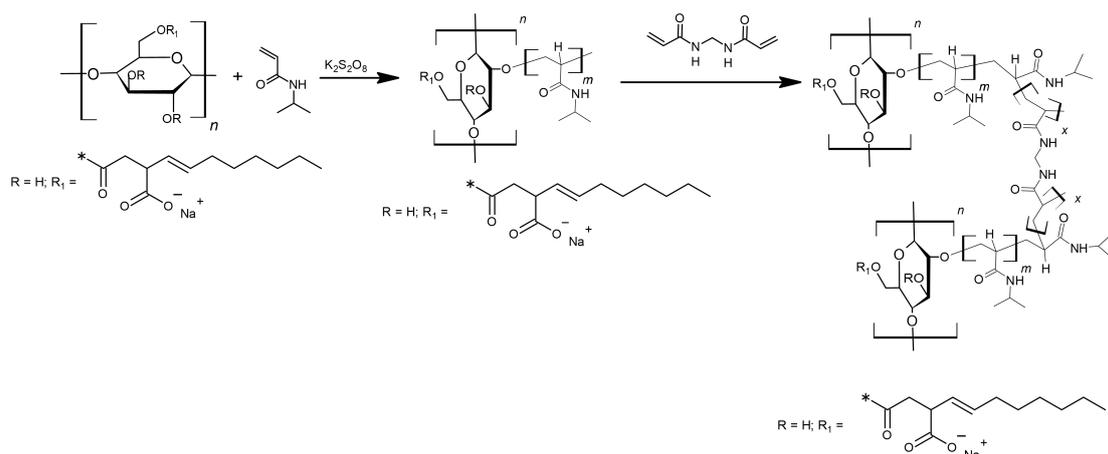


Fig. 1. Reaction scheme for synthesis of dextrin octenylsuccinate, dextrin octenylsuccinate-graft-poly(*N*-isopropylacrylamide) and cross-linked derivatives

Four dextrin octenylsuccinates (OSA) were synthesized by varying the content of OSA (4.37 %, 6.82 %, 8.05 %, and 10.67 %). Further, dextrin octenylsuccinate-graft-poly(*N*-isopropylacrylamide) copolymers were obtained via free-radical polymerization and crosslinked with *N*, *N'*-methylenebisacrylamide. Characterization techniques included FTIR, thermogravimetric analysis, DSC and dynamic light scattering to assess chemical structure, thermal stability, and thermo-responsive properties of synthesized derivatives.

The synthesized cross-linked grafted dextrin copolymers exhibited thermo-responsive behavior in water, with phase separation occurring at 31–33 °C. Moreover, a 10-hour swelling study was conducted in simulated gastric fluid (pH 1.2), intestinal fluid (pH 6.8), and blood plasma (pH 7.4) at 25 °C and 37 °C. Swelling increased with temperature, particularly in the gastric environment, due to enhanced water diffusion. Intestinal swelling was moderate, while the lowest swelling was observed at neutral pH conditions. Higher OSA content resulted in faster and greater swelling, with equilibrium reached within 400–500 minutes, and also higher thermal stability.

In this study thermo-responsive dextrin-based copolymers with tailored swelling properties and controlled phase transition in aqueous media were successfully developed, supporting their potential for controlled drug release and drug delivery applications.

[1] M. Sponchioni, U. Capasso Palmiero, and D. Moscatelli, "Thermo-responsive polymers: Applications of smart materials in drug delivery and tissue engineering," *Materials Science and Engineering: C*, vol. 102, pp. 589–605, Sep. 2019.