SYNTHESIS AND CHARACTERIZATION OF THERMO-RESPONSIVE β-CYCLODEXTRIN AND POLY(N-ISOPROPYLACRYLAMIDE) COPOLYMERS

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In recent years, the field of polymer science has expanded rapidly, leading to the emergence of a group of polymers that respond to environmental stimuli, such as temperature. Thermo-responsive polymers are widely used due to their reversible and rapid phase transformations that occur near human body temperature, making them of great importance in the biomedical and pharmaceutical fields, especially drug delivery systems [1]. To improve the encapsulation properties of these polymers, combination copolymers are being developed.

In this work, seven β-cyclodextrin and poly(N-isopropylacrylamide) graft copolymers were synthesized by performing radical copolymerization in an aqueous medium, using potassium persulfate as the initiator. By varying the molar ratio of β-CD:NIPAAm from 1:0.25 to 1:10, copolymers with different amounts of PNIPAAm side chains were obtained. The synthesized copolymers were characterized using spectroscopic and thermogravimetric methods. Turbidity and differential scanning calorimetry studies revealed that heated aqueous solutions of the synthesized graft copolymers exhibited thermo-responsive behavior when the temperature reached 30.8–32.8 °C, at which point phase separation occurred. The steady-state fluorescence emission of pyrene, a fluorescent probe dispersed in both the copolymer solutions and dispersions, showed that the intensity ratio of the characteristic first and third peaks indicated effective immobilization of pyrene within the graft copolymer molecules in all the samples. Thermo-responsive β-cyclodextrin and poly(N-isopropylacrylamide) graft copolymers with immobilization potential and controlled phase transition in aqueous media were successfully developed, supporting their potential for controlled drug release and drug delivery applications.

[1] A. J. Rosario and B. Ma, “Stimuli-Responsive Polymer Networks: application, design, and computational exploration,” ACS Applied Polymer Materials, vol. 6, no. 23, pp. 14204–14228, Apr. 2024, doi: 10.1021/acsapm.4c00002.