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# Fabrication of Thermo-responsive Cotton Fabrics Using Poly(vinyl caprolactam-co-hydroxyethyl acrylamide) Copolymer

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## Highlights

- Thermo-responsive copolymer P(VCL-co-HEAA) was synthesized and characterized.
- Cotton fabrics were grafted with P(VCL-co-HEAA) using BTCA as crosslinker.
- FTIR and EDS studies confirmed the successful grafting reaction.
- Treated cotton fabrics showed decreased permeability at elevated temperature.

## Abstract

A thermo-responsive polymer with hydrophilic to hydrophobic transition behavior, poly(vinyl caprolactam-co-hydroxyethyl acrylamide) P(VCL-co-HEAA), was prepared by copolymerization of vinyl caprolactam and N-hydroxyethyl acrylamide via free radical solution polymerization. The resulting copolymer was characterized by Fourier transform infrared spectroscopy (FTIR), <sup>1</sup>H nuclear magnetic resonance (NMR), gel permeation chromatography (GPC), differential scanning calorimetry (DSC), and thermogravimetric analysis (TGA). The lower critical solution temperature (LCST) of P(VCL-co-HEAA) was determined at 34.5°C. This thermo-responsive polymer was then grafted onto cotton fabrics using 1,2,3,4-butanetetracarboxylic acid (BTCA) as crosslinker and sodium hypophosphite (SHP) as catalyst. FTIR and energy dispersive X-ray spectroscopy (EDS) studies confirmed the successful grafting reaction. The modified cotton fabric exhibited thermo-responsive behavior as evidenced by water vapor permeability measurement confirming decreased permeability at elevated temperature. This is the first demonstration that a PVCL based copolymer is grafted to cotton fabrics. This study provides a new thermo-responsive polymer for fabrication of smart cotton fabrics with thermally switchable hydrophilicity.

**Keywords:** thermo-responsive polymer; poly(vinyl caprolactam) (PVCL); LCST; water vapor permeability; smart cotton fabric

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