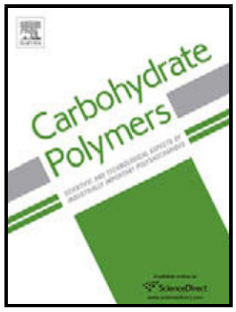

Title: Fabrication of Thermo-responsive Cotton Fabrics Using Poly(vinyl caprolactam-co-hydroxyethyl acrylamide) Copolymer

Authors: Min Xiao, Edurne González, Alexis Martell Monterroza, Margaret Frey

PII: S0144-8617(17)30729-4
DOI: http://dx.doi.org/doi:10.1016/j.carbpol.2017.06.092
Reference: CARP 12480

To appear in:

Received date: 21-2-2017
Revised date: 16-6-2017
Accepted date: 22-6-2017

Please cite this article as: Xiao, Min., González, Edurne., Monterroza, Alexis Martell., & Frey, Margaret., Fabrication of Thermo-responsive Cotton Fabrics Using Poly(vinyl caprolactam-co-hydroxyethyl acrylamide) Copolymer.*Carbohydrate Polymers* http://dx.doi.org/10.1016/j.carbpol.2017.06.092

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

Min Xiao[1], Edurne González [1], Alexis Martell Monterroza[2], Margaret Frey[1,*]
[1]Department of Fiber Science & Apparel Design, Cornell University, Ithaca NY 14850, USA
[2]Department of Chemistry & Chemical Biology, Cornell University, Ithaca NY 14850, USA
* Corresponding author. Tel.:+1-607-255-1937
Email address: mfw24@cornell.edu

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), ^{1}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