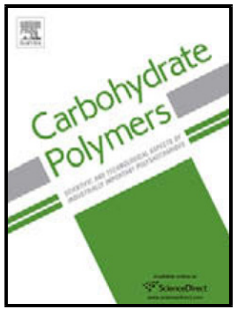

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PII: S0144-8617(17)31237-7
DOI: https://doi.org/10.1016/j.carbpol.2017.10.081
Reference: CARP 12930

To appear in:

Received date: 3-8-2017
Revised date: 14-10-2017
Accepted date: 22-10-2017

Please cite this article as: Ji, Bolin., Zhao, Cunyi., Yan, Kelu., & Sun, Gang., Effects of divalent anionic catalysts on cross-linking of cellulose with 1,2,3,4-butanetetracarboxylic acid.*Carbohydrate Polymers* https://doi.org/10.1016/j.carbpol.2017.10.081

Effects of divalent anionic catalysts on cross-linking of cellulose with 1,2,3,4-butanetetracarboxylic acid

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Highlights

- · Divalent PPA anions showed more efficient catalysis than monovalent ones.
- · 2Dcos was used to analyze the reactions between BTCA and cellulose.
- · Crosslinking and degradation of cellulose by BTCA are competing reactions.
- · The pH of BTCA bath played a key role in cotton finishing with PPA as the catalyst.
- · Fabrics treated at pH ≤ 3.2 presented good durability and satisfying strength.

ABSTRACT

1,2,3,4-Butanetetracarboxylic acid (BTCA) can efficiently esterify cellulose with pyrophosphoric acid (PPA) as a catalyst to remove protons of reaction intermediates. However, valence and relative concentration ratio (RCR) of catalyst anions correlating to pH of finishing bath played a critical role in the reactions. Results here indicated that wrinkle recovery angle, tensile strength retention and ester absorbance of fabrics treated at pH of 2.8 showed higher values. It was a competing reaction for BTCA molecules to esterify or depolymerize cellulose. Importantly, divalent PPA anions were more efficient than monovalent ones in catalyzing the esterification between anhydrides and cellulose, which was confirmed by FTIR results and two-dimensional correlation spectroscopy analyses and by the RCRs of PPA anions and their changing rates versus pH. Furthermore, the higher catalytic efficiency of divalent anions was proved by the selected model catalysts. Meaningfully, the fabrics treated at pH ≤ 3.2 presented good durability.

Keywords: Anti-wrinkle; Cross-linking; Valence; Strength; Two-dimensional correlation spectroscopy