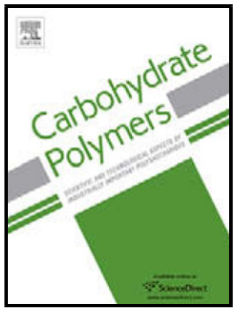

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Enhanced enzymatic hydrolysis of cellulose from waste paper fibers by cationic polymers addition

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Highlights

- Waste paper fibers are potential materials for bio-ethanol production.
- Cationic polymer enhanced enzymatic hydrolysis operated at 15% solids loading.
- The cellulose-cellulase binding was increased through electrostatic attraction.
- PEI resulted in the highest cellulase adsorption onto fibers by patching role.
- The cellulase loading could be reduced by addition of cationic polymer.

Abstract

Cationic polymers (cationic polyacrylamide (CPAM), polyethyleneimine (PEI) or cationic starch (CS)) were used to enhance the enzymatic hydrolysis of waste paper fibers (WPFs) at 15% (w/w) solids concentration. Results showed that 0.05 g/L PEI, CPAM and CS resulted in 72.5%, 65.9% and 59.7% conversion of WPFs, increased by 15.4%, 8.8% and 2.6%, respectively, compared with control (57.1%). PEI was shown to have a larger effect than CPAM and CS, and generate a total sugar concentration of 73.9 g/L. Improvement in hydrolysis with cationic polymer addition is attributed to increased cellulase adsorption on cellulose through electrostatic attraction, rather than enhancement of cellulase activity. A patching/ bridging mechanism of cationic polymer enhancement of cellulose adsorption in cellulose is hypothesized. PEI exhibited maximum cellulose binding for polymers examined and appears to promote binding through a patching mechanism. CPAM and CS adsorbed a relatively low cellulase through bridging mechanism. In addition, enzyme loading could be reduced by addition of cationic polymers to obtain the same glucose yield, especially when PEI was used.