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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 cellulase adsorption in cellulose is hypothesized. PEI exhibited maximum cellulase 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.

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