

Pretreatment of lignocellulosic material under hydrothermal condition for ethanol production

Yukihiko Matsumura, Takuya Yoshida, Daisuke Okahisa

Department of Mechanical System Engineering, Hiroshima University

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Hydrothermal pretreatment of lignocellulosic materials were investigated in terms of pretreatment for enzymatic hydrolysis and successive ethanol fermentation. The date in the literature was studied in terms of reaction kinetics, and reaction rate parameters for (1) cellulose conversion to degradable cellulose (i.e. cellulose that could be hydrolyzed by cellulase), (2) cellulose hydrolysis to glucose, (3) degradable cellulose hydrolysis to glucose, and (4) hydrothermal decomposition of glucose were determined. The result is shown in Fig. 1 and Table 1. Based on the resulting parameters, temperature profile for maximum glucose yield was derived by parameter fitting. Maximum glucose yield was 0.82. To maximize glucose yield, conversion to cellulose to degradable cellulose should be improved while suppressing the hydrothermal decomposition of the product glucose.

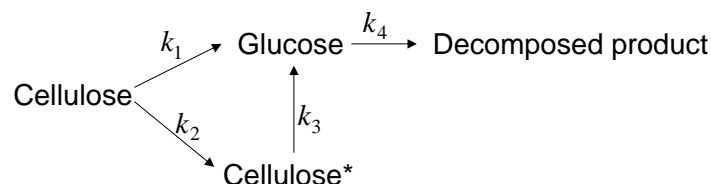


Fig. 1. Reaction network for hydrothermal pretreatment of cellulose considered in this study.

Table 1. Obtained reaction parameters.

| i | k_{0i} [s ⁻¹] | E_{ai} [J/mol] |
|-----|---------------------------------|-----------------------|
| 1 | 1.008E-03 | 5605.973 |
| 2 | 8.868E+01 | 42166.49 |
| 3 | 1.733E+10 | 129297.8 |
| 4 | 1.461E+04 | 61440.01 |

$$k_i = k_{0i} \exp(-E_{ai} / RT)$$