

PRETREATMENT OF LIGNOCELLULOSIC MATEIRAL UNDER HYDROTHERMAL CONDITION FOR ETHANOL PRODUCTION

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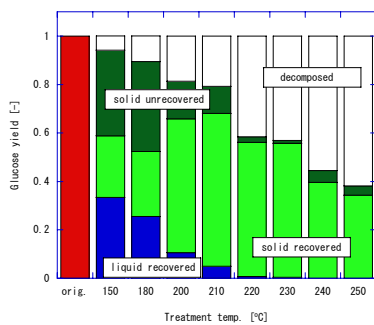
SUMMARY: Hydrothermal pretreatment of lignocellulosic materials were investigated in terms of pretreatment for enzymatic hydrolysis and successive ethanol fermentation. The date in the literature was studied in terms of reaction kinetics, and reaction rate parameters for (1) cellulose conversion to degradable cellulose (degradable by enzyme), (2) cellulose hydrolysis to glucose, (3) degradable cellulose hydrolysis to glucose, and (4) hydrothermal decomposition of glucose were determined. Based on the resulting parameters, temperature profile for maximum glucose yield was derived by parameter fitting. To maximize glucose yield, conversion to cellulose to degradable cellulose should be improved while suppressing the hydrothermal decomposition of the product glucose.

Purpose

To find the best treatment condition for hydrothermal pretreatment of lignocellulosics for ethanol production.

Reaction parameter determination

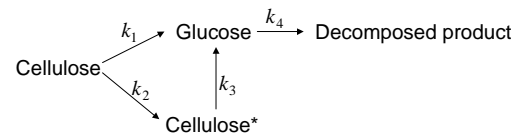
Literature data (Ballesteros et al., Applied Biochemistry and Biotechnology, 98-100, 717-732, 2002) was studied for reaction rate parameter determination.



Ballesteros et al. (2002)

Pretreatment
autoclave
50 mK/s
rapid cool down

Enzymatic hydrolysis
10% (w/v) substrate
15 FPU/g-substrate
50°C, 72 h

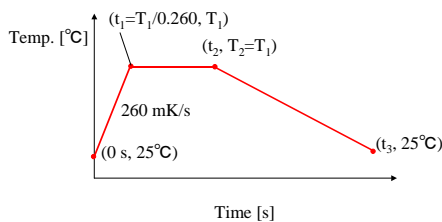


<i>i</i>	k_{0i} [s ⁻¹]	E_{ai} [J/mol]
1	1.008E-03	5605.973
2	8.868E+01	42166.49
3	1.733E+10	129297.8
4	1.461E+04	61440.01

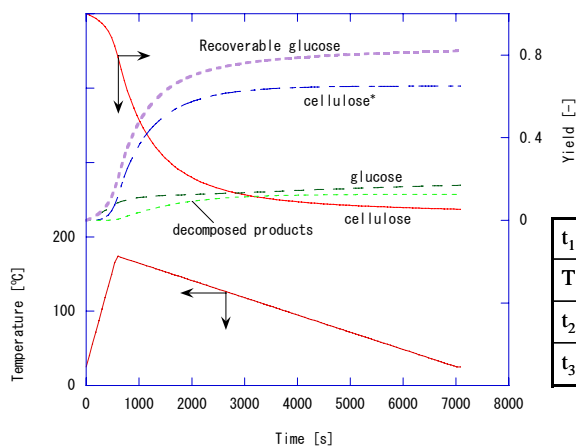
$$k_i = k_{0i} \exp(-E_{ai} / RT)$$

Results and discussions

Temperature profile was optimized to maximize the sum of glucose yield and degradable cellulose yield.



Heating rate was maximum rate available for the autoclave operation.,



t_1 [s]	574.9057
$T_1 = T_2$ [°C]	174.4755
t_2 [s]	574.9057
t_3 [s]	7022.186

Conclusions

Based on the reaction parameters obtained in the literature, optimum temperature profile for lignocellulosic pretreatment was determined. The highest yield of recoverable glucose is 0.82 for the optimum condition.. Suppressing of product glucose decomposition is important.

This research was carried out as a project of the NEDO International Joint Research Grant Program. 🍀