Supplemental data 1: Kinetic modeling of dilute acid hydrolysis for formation of xylose

The xylose concentration during dilute acid hydrolysis by dilute sulfuric acid of 0.4-5.0 wt% can be predicted by the following pseudo-homogenous kinetic model:

$$C_{\mathrm{Xl}}=\frac{a}{k_{\mathrm{X3}}-k_{\mathrm{X1}}}\exp(-k_{\mathrm{X1}}t)-\frac{a}{k_{\mathrm{X3}}-k_{\mathrm{X2}}}\exp(-k_{\mathrm{X2}}t)+\left[\frac{a}{k_{\mathrm{X3}}-k_{\mathrm{X2}}}-\frac{a}{k_{\mathrm{X3}}-k_{\mathrm{X1}}}\right]\exp(-k_{\mathrm{X3}}t) \tag{1}$$

where C_{Xl} is xylose concentration, g/L; $a=\frac{1.136C_{\mathrm{Xn0}}k_{\mathrm{X1}}k_{\mathrm{X2}}h_{dX}}{k_{\mathrm{X2}}-k_{\mathrm{X1}}}$; C_{Xn0} is the initial concentration of xylan in the pseudo-homogenous system; h_{dX} is the potential hydrolysis degree; and k_{X1}, k_{X2} and k_{X3} are rate constants for xylan dissolution, formations of xylo-oligomers and xylose, respectively. For dilute acid hydrolysis of sugarcane bagasse , h_{dX}, k_{X1}, k_{X2} and k_{X3} can be estimated by the following equations:

$$h_{d\mathrm{X}}=1-\frac{0.20}{C_{\mathrm{SA}}^{0.33}R_0^{0.60}} \tag{2}$$

where $R_0=\exp(\frac{T'-100}{14.75})$, and T' is hydrolysis temperature in ˚C, and

$$k_{\mathrm{X1}}=4.52\times10^{18}\times\exp(-\frac{132520}{RT})C_{\mathrm{SA}}^{0.60} \tag{3}$$

$$k_{\mathrm{X2}}=3.82\times10^{15}\times\exp(-\frac{107410}{RT})C_{\mathrm{SA}}^{0.72} \tag{4}$$

$$k_{\mathrm{X3}}=6.60\times10^{15}\times\exp(-\frac{123710}{RT})C_{\mathrm{SA}}^{0.86} \tag{5}$$

Therefore, by using this model, the formation of xylose at different sulfuric acid concentrations and temperatures can be estimated as shown in Figure S1. The results illustrate that xylose degradation increases dramatically at temperature higher than 160˚C. If the hydrolysis is performed at a high temperature, a short retention time (several seconds to minutes) is preferred, and a relatively long time and high acid concentration are preferred if the hydrolysis is conducted at a low temperature.

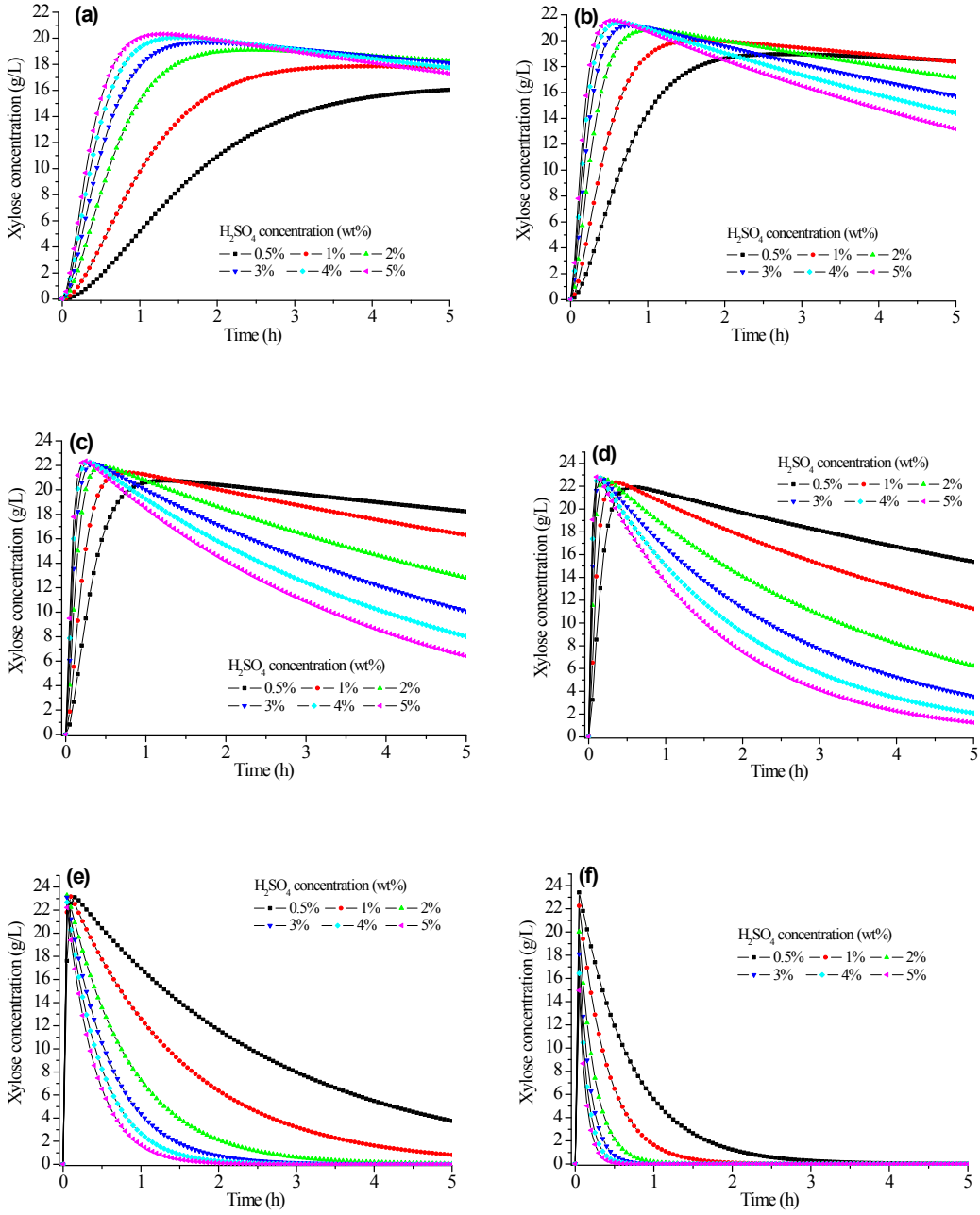

Figure S1 Model-predicted data for xylose concentration by dilute H_2SO_4 hydrolysis of lignocellulosic biomass at different temperatures with various acid concentrations (a) 130˚C; (b) 140˚C; (c) 150˚C; (d) 160˚C; (e) 180˚C; (f) 200˚C

Supplemental data 2: Simultaneous saccharification and fermentation of dilute acid pretreated solid

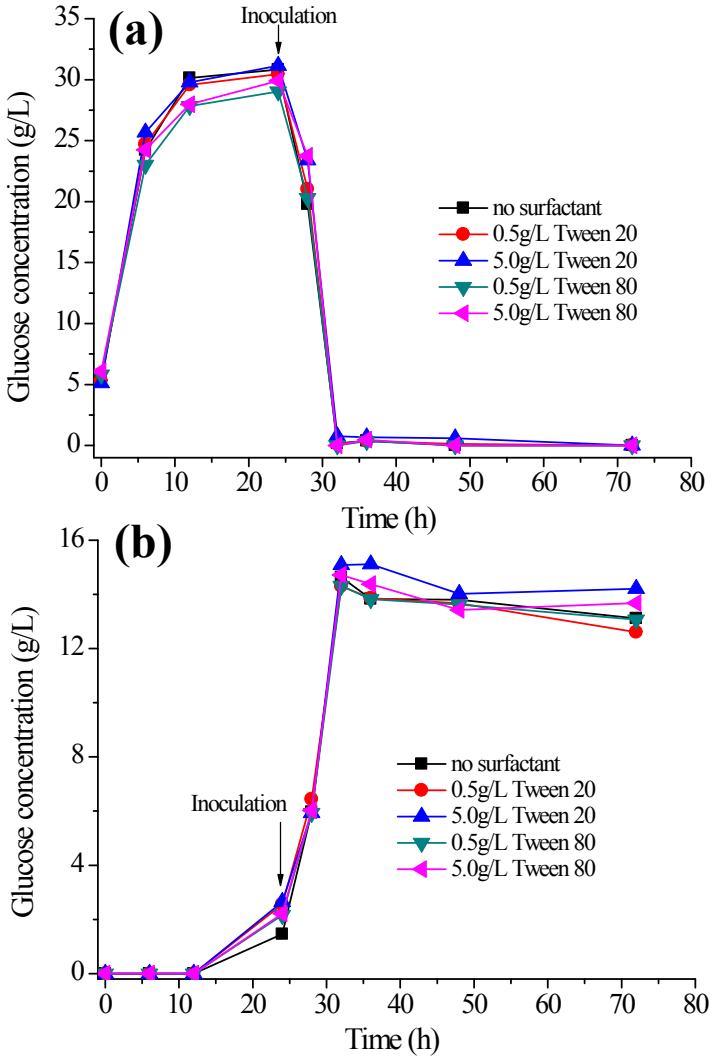

Figure S2 SSF of dilute acid pretreated (0.5% H_2SO_4 at 140°C) solid for ethanol production with addition of surfactant. (a) glucose concentration; (b) ethanol concentration (g/L). Other conditions: Solid loading 10%, Enzyme loading 20 FPU/g