Conversion of Ligno Cellulose to Biofuel

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Abstract : *A two-stage process using aqueous ammonia and hot-water has been investigated to fractionate corn stover. To optimize the fractionation process so that hemicellulose recovery and purity in the liquid hydrolysate were maximized, the experiments were carried out employing response surface methodology (RSM). A central composite design (CCD) was used to evaluate and confirm the effectiveness and interactions of factors. The optimal fractionation conditions were determined to be as follow: (1) First-stage reactor operated in batch mode using a 15% NH4OH solution (WNH3 =15%) at 1:10 solid:liquid ratio, 60 °C and 24 h; (2) second stage percolation reactor operated using hot-water at 20 ml/min, 200 °C, and 10 min. The model predicted 51.5% xylan recovery yield and 82.4% xylan purity under these conditions. Experiments confirmed the maximum xylan recovery yield and purity were 54.7% and 83.9% respectively under the optimal reaction conditions.*

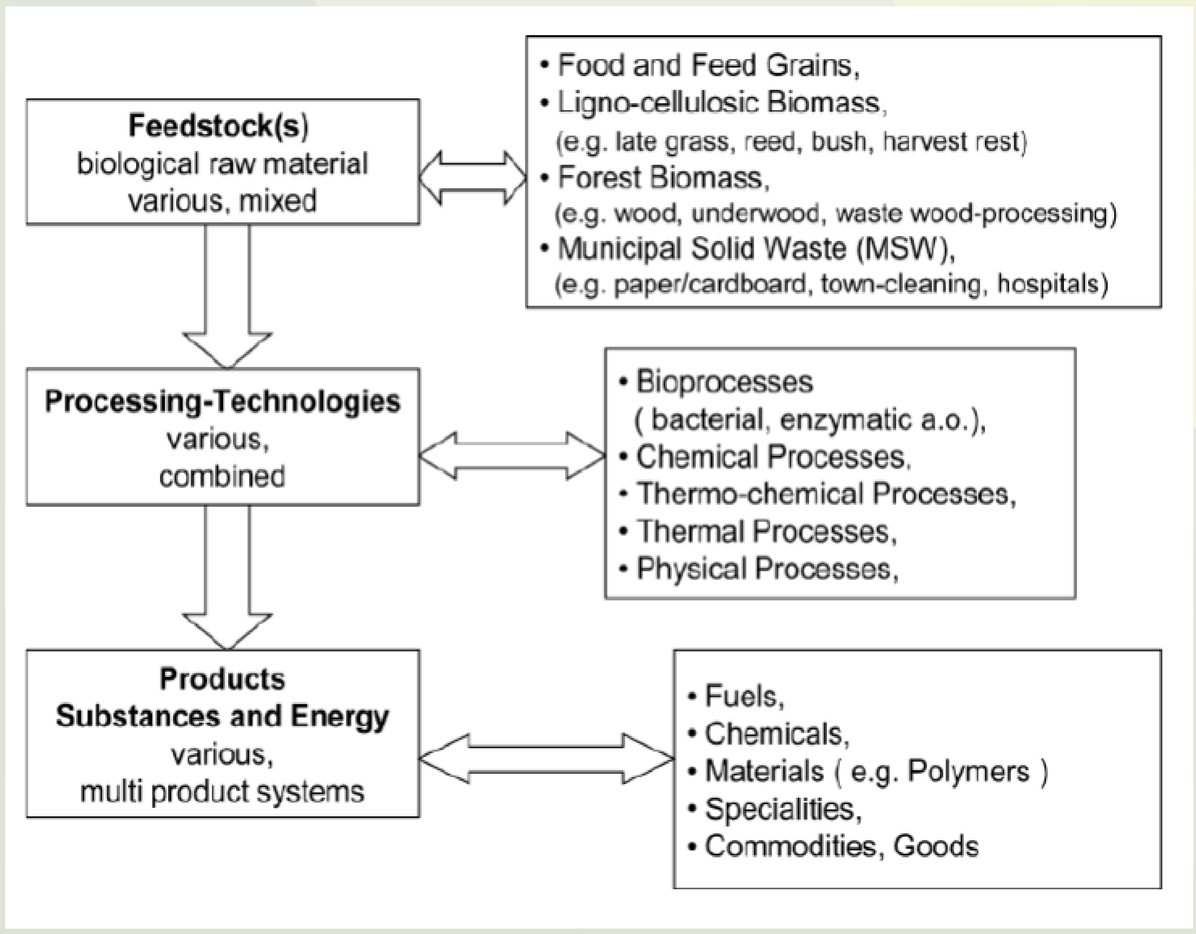


Fig. 1. Basic principles of a biorefinery

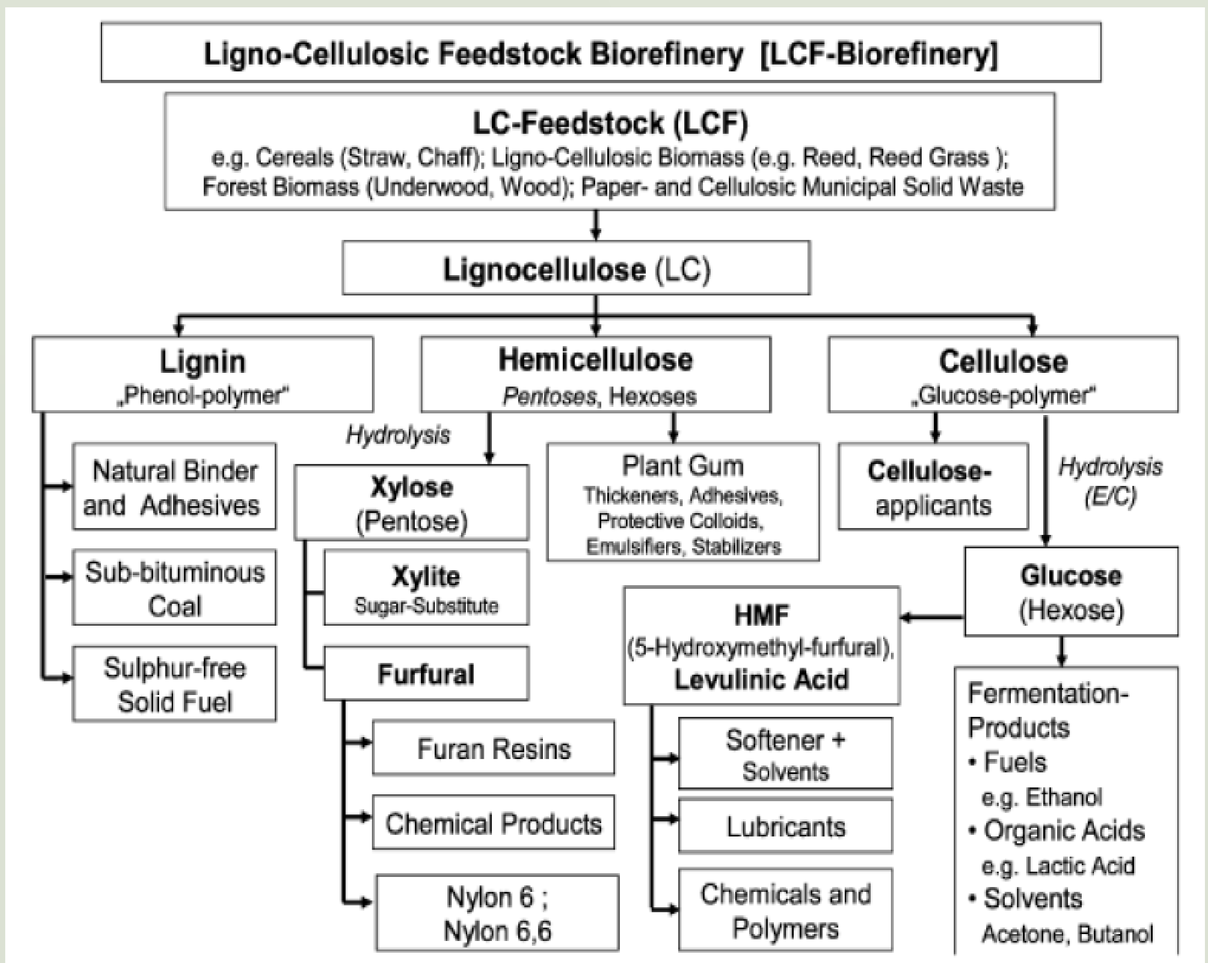


Fig. 2. Lignocellulosic feedstock biorefinery

Methods

Materials

Air-dried ground corn stover which includes stalks, leaves, tassel, husks, and cobs

Experimental setup and Operation

Corn stover was treated with 15% NH4OH solution (WNH3 =15%) in glass media bottles (Fischer Cat# 06-414-1C) at 60 °C for 24 h. Solid-to-liquid ratio was kept at 1:10.

Second stage: hot-water treatments

The reactor system for the second stage treatment consists of a flowthrough column reactor with preheating coil, an HPLC (high performance liquid chromatography) pump (Series II pump, Chrom Tech, Inc., MN), a temperature-programmable GC (gas chromatography) oven, solution reservoirs and a sample cylinder tank.

Enzymatic digestibility test

The enzymatic digestibilities of solid samples obtained from two-stage fractionation were determined in duplicate according to the NREL Chemical Analysis and Testing Standard Procedure.

Results and discussion

RSM

The optimal reaction conditions of the first stage treatment using 15% NH4OH solution (WNH3 =15%) were chosen on the basis of the previous study as follows: 1:10 solid:liquid ratio using a 15% NH4OH solution (WNH3 =15%) and 60 °C for 24 h

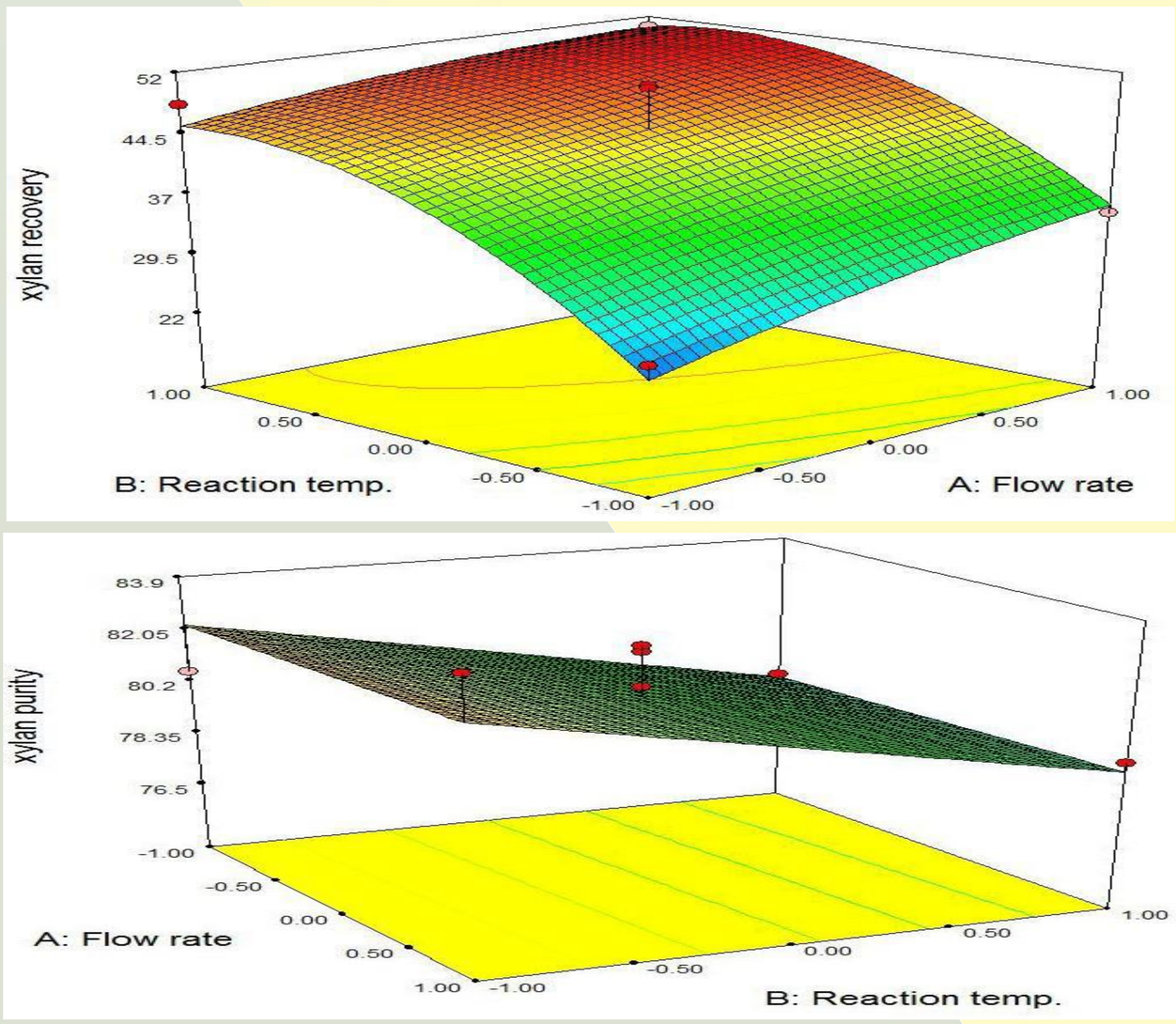


Fig. 2 Response surface curve

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