

Reactivity of glucan and xylan in corn stover: Effect of pelleting and deacetylation on dilute acid pretreatment

Bruno Godin^{1,2}, Nick Nagle¹, Jérôme Delcarte², and Edward Wolfrum¹

¹ National Renewable Energy Laboratory (NREL). National Bioenergy Center

² Walloon Agricultural Research Center (CRA-W). Valorisation of Agricultural Products Department - Biomass, Bioproducts and Energy Unit

Corresponding email : b.godin@cra.wallonie.be

Introduction

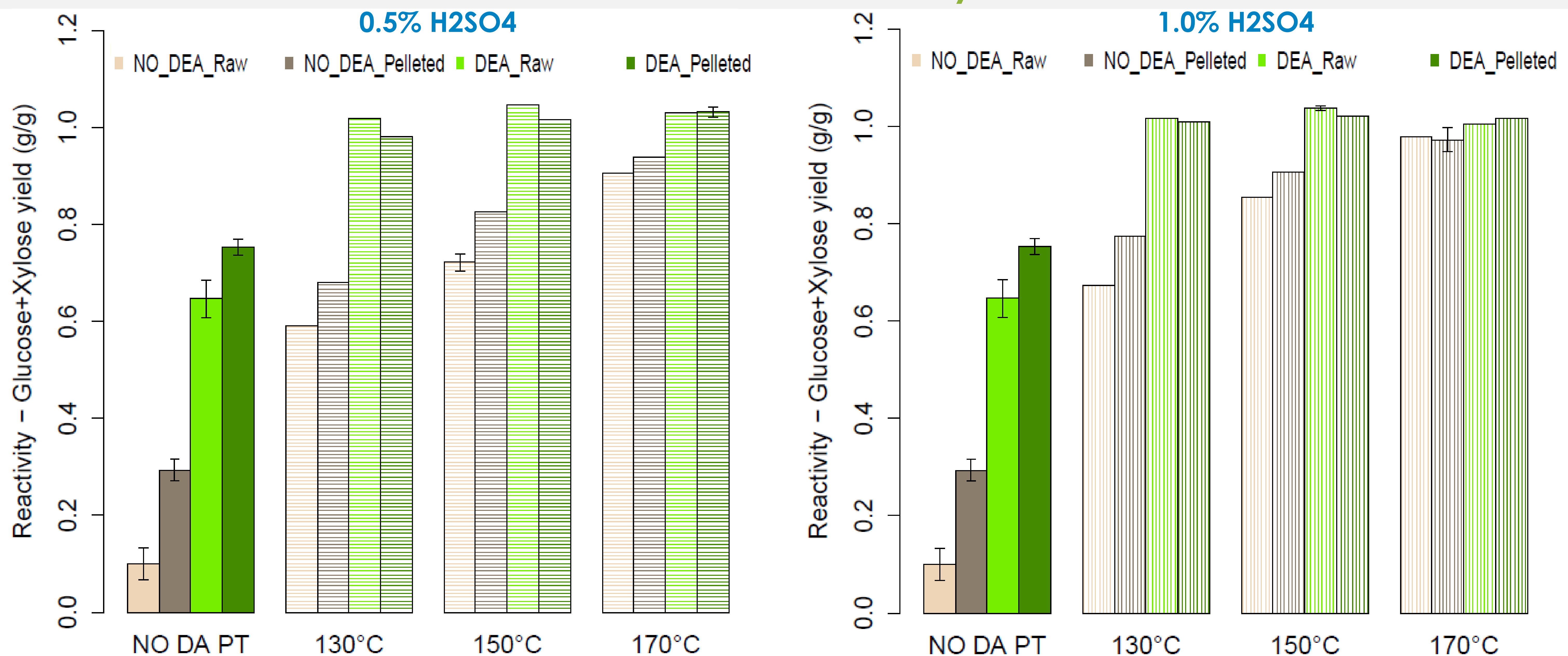
It is essential to **maximize the production of monomeric carbohydrates** from glucan (cellulose) and xylan (hemicelluloses) of feedstock for **biofuel production processes to be economically efficient**. It is also important to improve the logistics by increasing the density of feedstock. The maximization of the monomeric carbohydrate production can be accomplished by using a pretreatment **enhancing the reactivity such as deacetylation**. It is a dilute NaOH pretreatment enabling to remove the acetyl groups of xylan. The densification of feedstock can be achieved by pelleting.

Method

A **laboratory-scale screening tool (ASE350) working at relevant biofuel process conditions** has been used to evaluate the effect on the combined reactivity of glucan and xylan of corn stover made by deacetylation (DEA) and by pelleting. Three different temperatures of dilute acid (DA) pretreatment (PT) have been studied: 130°C, 150°C and 170°C. Two different acid concentration of dilute acid (DA) pretreatment (PT) have been studied: 0.5% H₂SO₄ and 1.0% H₂SO₄.

Results

Corn stover reactivity



• **High significant effect of deacetylation (p<0.001) → High increase of reactivity with deacetylation**

No Deacetylation (NO_DEA)

- High significant effect of temperature (p<0.01) → High increase of reactivity with increased temperature
- Low significant effect of catalyst (p<0.05) → Low increase of reactivity with increased catalyst concentration
- Low significant effect of pelleting (p<0.05) → Low increase of reactivity with pelleting

Deacetylation (DEA)

- No significant (p>0.05) temperature, catalyst and pelleting effect
- No dilute acid pretreatment (PT) with deacetylation → Similar or better reactivity compared to dilute acid pretreatment (PT) at 130°C without deacetylation

Conclusions

• **Deacetylation before dilute acid pretreatment enables a major improvement of corn stover reactivity.**

When corn stover is deacetylated, temperature and acid concentration of dilute acid pretreatment, and pelleting don't affect its reactivity.

- Pelleting doesn't improve the reactivity of deacetylated corn stover. However, pelleting enables a minor improvement of reactivity of none deacetylated corn stover.

When corn stover is not deacetylated, temperature and acid concentration of dilute acid pretreatment, and pelleting improve its reactivity.

• **Higher pretreatment severity reduces the differences in recalcitrance among feedstocks and the effect of additional preprocessing.**