Reactivity of glucan and xylan in brewer's spent grain : Comparing of dilute alkaline versus liquid hot water pretreatment

Bruno Godin[1], Grégoire B.L. Henry[2], Thibaut Masy[1], Thomas Nicolay[2], Florent Awedem Wobiwo[2], Patrick A. Gerin[2], Jérôme Delcarte[1]

[1]Walloon Agricultural Research Center - CRA-W. Valorisation of Agricultural Products Department. Chaussée de Namur, 24 - B-5030 Gembloux - Belgium

[2]Université catholique de Louvain, Earth & Life Institute - Bioengineering Group, Croix du Sud, 2 Box L7.05.19 - B-1348 Louvain-la-Neuve - Belgium

b.godin@cra.wallonie.be

Introduction

- **Cellulosic biomasses pretreatment**

→ High availability of brewer's spent grain resource

→ Reduce recalcitrant to enzymatic and/or microbial digestion to produce biofuels and/or biochemicals

→ Find an economically efficient pretreatment pathway

- **Aim**

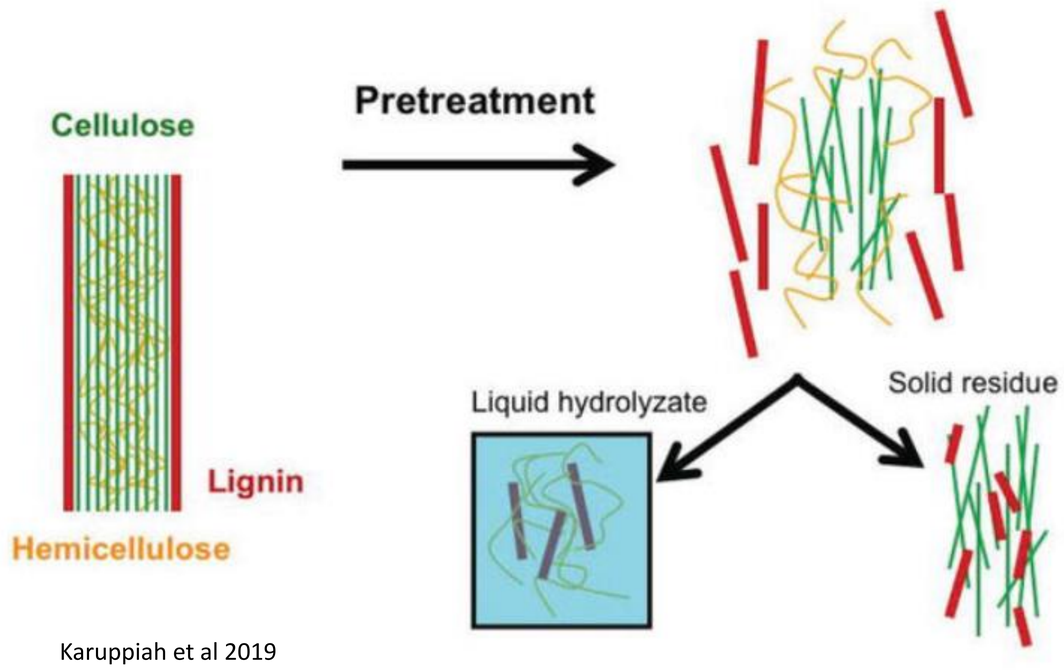
→ Make brewer's spent grain glucan (cellulose) and xylan+arabinan (hemicelluloses) more reactive for further valorization

- **Experiments**

→ Laboratory-scale pressure reactor Parr 4540 loaded with 4% of dry solid loading under pretreatment different conditions

→ Analysis of sugars with standard NREL (or equivalent) procedures

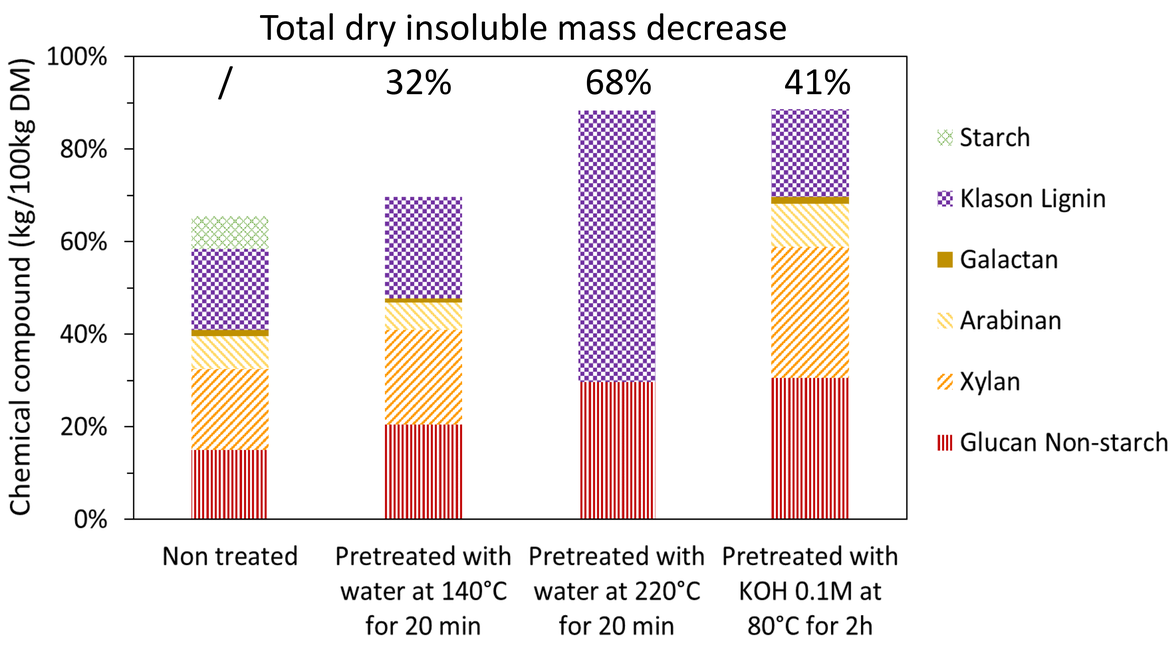
→ Analysis of anaerobic digestion with standard methane potential procedure



Karuppiah et al 2019

Chemical composition

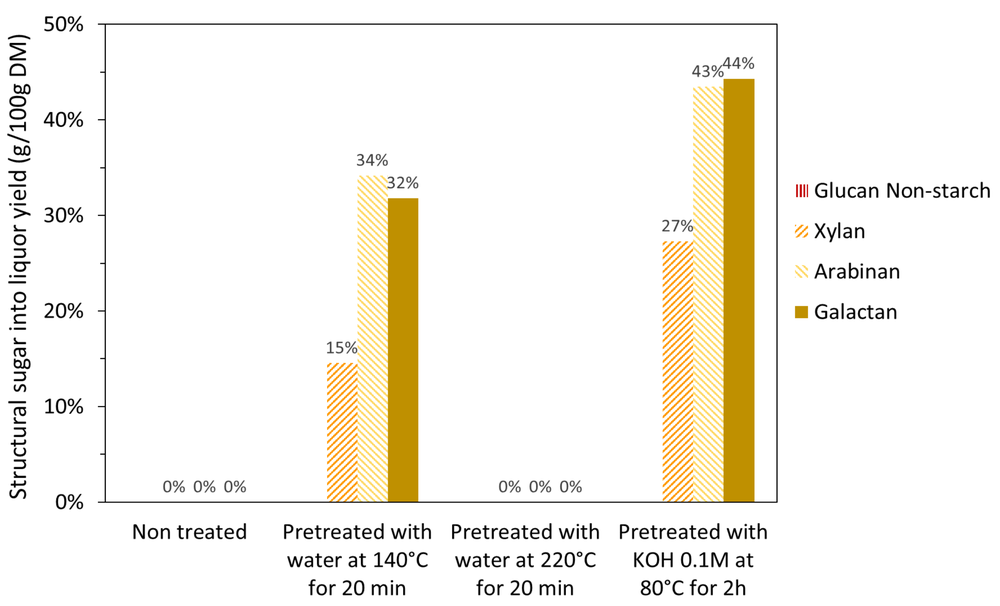
Insoluble fraction from pretreatment



→ Dilute alkaline pretreatment concentrates cellulose and hemicelluloses and reduces the lignin content

→ Starch is solubilized by the 3 pretreatments

Soluble fraction from pretreatment

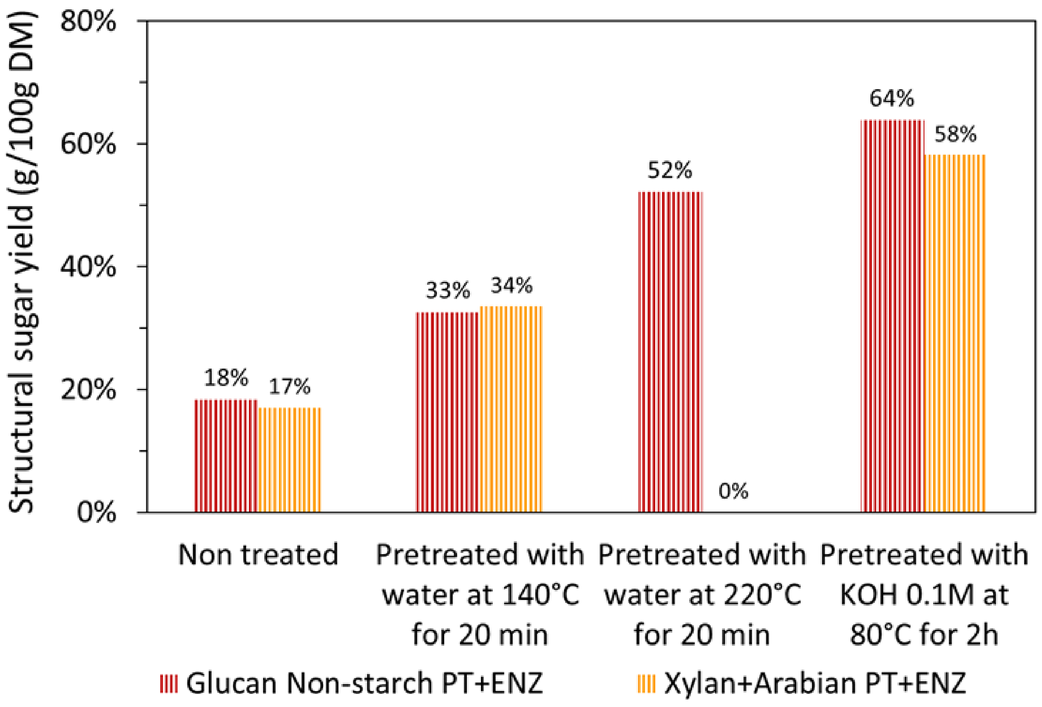


→ Dilute alkaline pretreatment keeps the solubilized hemicelluloses sugars into the liquor without destroying them

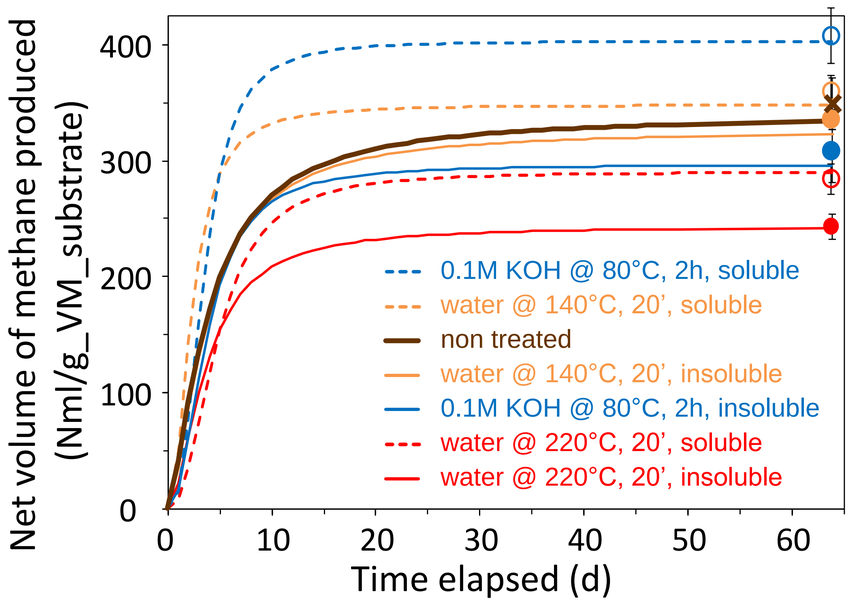
→ Liquid hot water pretreatment rapidly destroys hemicelluloses sugars of the liquor into non-sugars

Reactivity

Combined reactivity of pretreatment (PT) and cellulolytic enzyme digestion (ENZ)



Reactivity to anaerobic microbes



→ Fast and high methane production

→ Loss of dry matter due to the pretreatment should be assessed with a higher degree of accuracy to be able to have a better understanding of the anaerobic digestion potential for the combination of the insoluble and soluble fractions

→ Dilute alkaline pretreatment at low severity enables an high reactivity of both cellulose and hemicelluloses of brewer's spent grain in comparison to liquid hot water pretreatment which has a higher severity and lower reactivity

Wallonie recherche CRA-W

e-Bio2Chem project

Walloon Agricultural Research Centre

To address today's questions and to prepare tomorrow's challenges

www.cra.wallonie.be

UCLouvain