MAXIMIZATION OF MONOMERIC C5 SUGARS FROM WHEAT BRAN USING RUTHENIUM-SUPPORTED CATALYSTS

Nuria Sánchez-Bastardo, E. Alonso
University of Valladolid, Department of Chemical Engineering and Environmental Technology, Valladolid, Spain
nuriasanchez2791@gmail.com

Wheat bran has become a very interesting biomass in biorefineries due to its high content in sugars. **Arabinoxylans**, the most abundant fraction in wheat bran, have important applications in pharmaceutical and food industries. However, their volume market is larger for the corresponding monomeric sugars (**arabinose** and **xylose**). Arabinose and xylose are susceptible to be converted in precursors of several platform molecules such as arabitol and xylitol. Processing wheat bran to obtain sugar alcohols consists of three consecutive steps (Fig. 1):

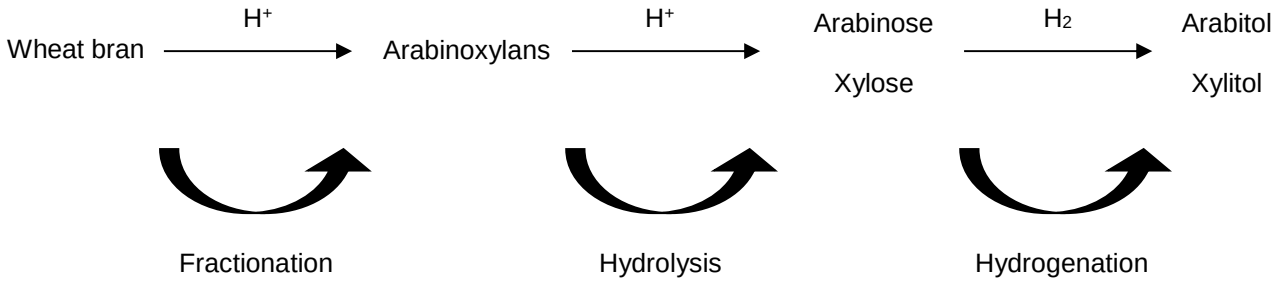

Fig 1. Production of platform molecules from wheat bran.

In this work, a two step catalytic process using heterogeneous catalysts has been developed to maximize the production of monomeric arabinose and xylose from wheat bran. The first step consists of wheat bran fractionation using hot compressed water and **$RuCl_3$/Al-MCM-48** as catalyst, resulting in a liquid extract enriched in arabinoxylans with a relatively low molecular weight [1]. In the second step, the previous arabinoxylans solubilized in water are subjected to a further hydrolysis process using the same catalysts. These heterogeneous catalysts are a very good option to overcome the disadvantages of traditional methods, such as acid or enzymatic hydrolysis. They can be easily recovered and can also shorten reaction times, minimizing further degradation into molecules such as furfural.
From the fractionation step, around 80% of the total arabinoxylans present in wheat bran are solubilized in water with an average molecular weight of 9 kDa, but only 20% of the total arabinoxylans extracted are monosaccharides [1]. A second step is therefore required to complete the hydrolysis into monomeric C5 sugars (arabinose and xylose). A high hydrolysis yield of 96 and 94% for arabino- and xylo-oligosaccharides, respectively, is achieved just in 15 minutes and 180 ºC. In addition to this, the amount of furfural detected in the liquid after hydrolysis is negligible, what means that hardly any degradation of monomers occurs.
Therefore, $RuCl_3$/Al-MCM-48 catalysts have been demonstrated to be efficient in both steps: wheat bran fractionation and arabinoxylans hydrolysis.

Acknowledgements

Authors gratefully acknowledge the financial support of Spanish Government through the Research Project CTQ2015-64892-R (MINECO/FEDER). N. Sánchez-Bastardo thanks Ministerio de Educación Cultura y Deporte for financial support through a FPU predoctoral contract (FPU14/00812).

References

[1]Sánchez-Bastardo, N., Romero, A., & Alonso, E. (2017). Extraction of arabinoxylans from wheat bran using hydrothermal processes assisted by heterogeneous catalysts. *Carbohydrate Polymers, 160,* 143-152.