© Jean Weber, INRAE

Exploiting agricultural waste to obtain molecules of interest

Read more

Vojvodić Cebin A. *et al.*

Valorisation of walnut shell and pea pods as novel sources for the production of xylooligosaccharides

Carbohydrate Polymers . 2021

https://doi.org/10.1016/j.carbpol.2021.117932

Contact

Estelle Bonnin

UR BIA

estelle.bonnin@inrae.fr

Context

Recovering agricultural waste is an essential part of sustainable crop and food production. The aim is to reduce the negative environmental impact of waste and generate economic benefits by creating value-added products. The non-consumable parts of plants such as peels, skins, hulls, husks, pods, fruit stones, stems, leaves and pomace represent readily available secondary raw materials that can be used to produce energy, materials and chemicals, or as new and unconventional sources of functional ingredients.

The objective of this research was to evaluate walnut shells and pea pods as sources for producing xylooligosaccharides (XOS). XOS are known to have prebiotic activity. They are non-digestible oligosaccharides that are selectively metabolised by part of the human microbiota, with health benefits arising from the production of short-chain fatty acids and the stimulation of probiotic strains, such as bifidobacteria.

Results

Hemicellulose from walnut shells and pea pods was obtained by combining different delignification and alkaline extraction parameters.

Under optimal conditions, the soluble fractions contained up to 45 % xylose, and the insoluble fractions more than 75 %. Structural analysis of these polysaccharides shows a xylan, which was not highly branched, with very few glucuronic acid residues in the insoluble fractions and more complex structures in the soluble fractions. Different conditions of degradation by GH11 xylanase from *Neocallimastix patriciarum* were applied and resulted in a maximum xylan conversion rate of 70 % on walnut shells and 90 % on pea pods. Analysis of the hydrolysis products shows the presence of xylobiose and xylotriose with low enzyme concentration, and xylose and xylobiose with higher enzyme concentration.

Future outlook

Given that the prebiotic activity of XOS requires further research, the choice of optimal hydrolysis conditions will depend on the contribution of each XOS to the prebiotic effect, their potential synergistic effects and the cost-effectiveness of hydrolysis in relation to time, the amount of xylanase added and the xylan conversion rate.