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Characterisation of cell wall polysaccharides in black currants

Hauke Hilz, Henk A. Schols, Alphons G.J. Voragen

Introduction

In berry juice production cell wall polysaccharides are becoming more and more important. They can cause viscosity problems when released into the juice, but are suggested to give health benefits, as well. To date treatment of berries with cell wall degrading enzymes has been required in juice production to gain reasonable yields. In the near future not only yield but also functionality will be of interest for the juice producing industry.

The aim of this study is to improve existing technologies for berry juice production as well as to establish novel enzyme and physical treatments to produce healthier juice enriched in phenolic compounds and polysaccharides. Or task within this project is monitoring the changes in cell wall polysaccharides during different processing steps.

Materials and Methods

Berries used are Finnish black currants (*Ribes nigrum*). Cell wall material was extracted with 70 % aqueous ethanol (alcohol insoluble solids, AIS) and further fractionated with 0.05 M NaOAc buffer at pH 5.2 and 70 °C (hot buffer soluble solids, HBSS), 0.05 M EDTA and 0.05 M $NH_4C_2O_4$ in 0.05 M NaOAc at pH 5.2 and 70 °C (chelating agent soluble solids, ChSS), 0.05 M NaOH at 0 °C (diluted alkali soluble solids, DASS) and 6 M NaOH at 0 °C (concentrated alkali soluble solids, CASS)[3]. The juice was ultrafiltrated through a 10 kDa membrane to obtain the juice polysaccharides (MHR).

Sugars composition, degree of acetylation (DA) and methylation (DM), and molecular weight distribution were determined as described[1].

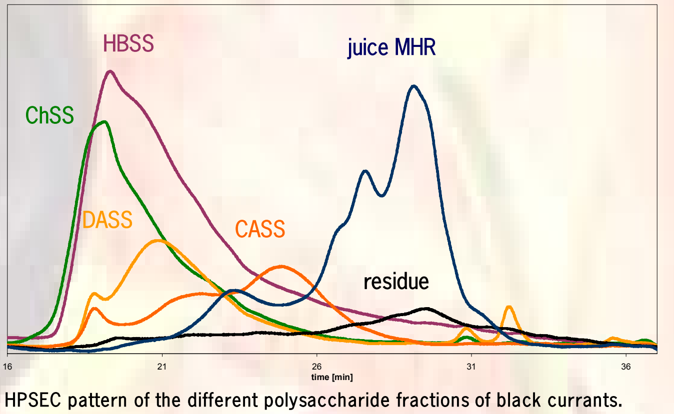
Sugar composition of black currants [mol %].

	Rha	Fuc	Ara	Xyl	Man	Gal	Glc	UrA	DA*	DM*	tot. sug. [% w/w]
AIS	2	0	11	6	13	6	20	41	55	26	38
juice MHR	10	0	24	2	2	7	9	48	57	22	40
press cake AIS	1	0	6	9	24	5	34	21	24	55	34
HBSS	1	0	6	2	0	3	1	87	91	8	62
ChSS	1	0	6	0	0	2	0	90	58	4	65
DASS	3	0	19	1	0	17	1	60	2	2	41
CASS	1	2	6	37	16	8	23	8	3	1	63
residue	1	0	8	9	33	4	34	11	2	5	35

*mol acetyl/methyl per 100 mol GalA

Results and Discussion

The Table shows the sugar composition of the different berry polysaccharide fractions as well as of the polysaccharides from juice and press cake. The polysaccharides patterns of these berries are comparable to those of the same fractions obtained from other fruits such as apple[1], grape[2] or olives[3]. HBSS and ChSS contain most of the uronic acids present in the AIS of berries, representing homogalacturonan. In DASS the high content of rhamnose shows that under these conditions most of pectic hairy regions with a rhamnogalacturonan I backbone are extracted. CASS contain still some uronic acids but mainly sugars typical for hemicelluloses (glucose, xylose, mannose), while the residue contains glucose as main sugar. The polysaccharide fraction isolated from the juice shows the typical pattern of hairy regions. In press cake the polysaccharide pattern is only differing from that of the residue in the molar contents of uronic acid and mannose. Black currants contain a high amount of mannose in the residue and in the CASS. It was shown that mannans are located in the seeds.



HPSEC pattern of the different polysaccharide fractions of black currants.

The HPSEC pattern shows that polysaccharides of high MW are extracted into HBSS and ChSS (homogalacturonan). The harsher the conditions are the less polymeric are the solubilised polysaccharides, as seen in DASS and CASS. The MHR from enzyme treated juice are of lower molecular weight than all other fractions. The peak at 27 min is expected to be rhamnogalacturonan II, the most complex structural pectic element known to date.

Conclusions

We analysed cell wall polysaccharides in black currants in detail and showed that polysaccharides of black currants have similar structures to those of other fruits. This basic characterisation of cell wall polysaccharides in berries and end products of juice processing makes it possible to compare the effect of novel treatments (e.g. flash release, ultra sonic or high pressure) on cell wall polysaccharides during juice production or waste upgrading very easily.

References

1. Schols, H.A., Vierhuis, E., Bakx, E.J., and Voragen, A.G.J., Carbohydr. Res., **275**, 343-360 (1995).
2. Vidal, S., Williams, P., O'Neill, M.A., and Pellerin, P., Carbohydr. Polym., **45**, 315-323 (2001).
3. Vierhuis, E., Schols, H.A., Beldman, G., and Voragen, A.G.J., Carbohydr. Polym., **43**, 11-21 (2000).

Wageningen University
Dept. of Agrotechnology and Food Sciences
Laboratory of Food Chemistry
P.O. Box 8129
NL-6700 EV Wageningen
The Netherlands
E-mail: hauke.hilz@wur.nl
http://www.ftns.wau.nl/lmt/
http://maxfun.vtt.fi

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