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Cell Wall Polysaccharides in Berries: Effect of High Pressure Treatment

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Introduction

High-pressure processing (HPP) is one of the prosperous techniques in food processing. Under HPP conditions the activities and specificities of different pectinolytic enzymes may change significantly [1, 2]. In juice production pectinolytic enzymes are used to degrade a highly viscous pectin gel, which is formed after mashing of the berries, because the higher the viscosity of the mash the lower is the juice yield.

In this study black currants (*Ribes nigrum* L.) and bilberries (*Vaccinium myrtillus* L.) were treated with high pressure to show how HPP affects cell wall polysaccharides and to discuss the role of endogenous enzymes.

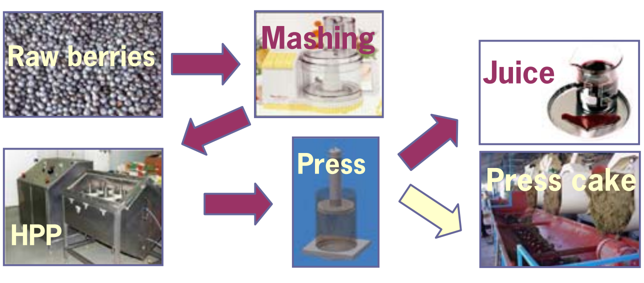

Figure 1. High pressure processing during juice production on laboratory scale.

Materials and Methods

Berries were mashed and treated with 400 MPa, at 32-43°C for 15 min before pressing (fig. 1).

After preparation, alcohol insoluble solids (AIS) were sequentially extracted with different buffers [3].

The degree of methyl esterification (DM) was determined by headspace GC [3]. Total uronic acids were determined after seaman hydrolysis by the mHDP-colour assay [3].

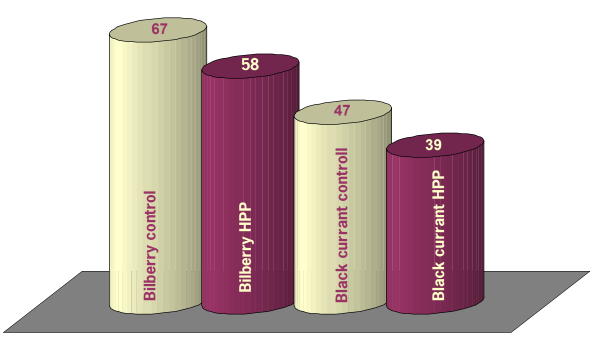

Figure 2. Degree of methyl esterification of pectin in AIS after HPP treatment [%].

Results and discussion

The HPP of berry mashes caused a lower juice yield compared to untreated ones, although tissue damage and therefore an increased juice yield was expected. The sugar compositions of the AIS from HPP treated and untreated mash do not differ significantly.

The degree of methyl esterification (DM) of AIS from bilberries and black currants, however, is lower in HPP mash compared to untreated mash (fig. 2). This change in DM influences the extractability (fig. 3) and therefore the amount of pectin involved in gel formation after mashing, and the strength of the gel. Pectin is easier to extract after HPP treatment as can be seen by extraction of more uronic acid with hot buffer (HBSS). In chelating agent soluble solids (ChSS) this trend is similar for bilberries, but not for black currants. Diluted alkali (DASS) can only partly extract the remaining pectin. Uronic acid remaining in the residue after extraction with concentrated alkali (CASS) is located in the seed and therefore hardly extracted [3].

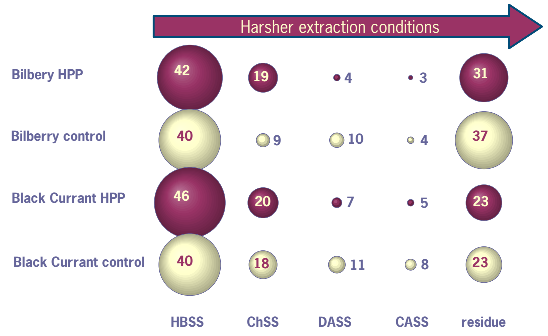

Figure 3. Yield of total uronic acids in different fractions [%].

Conclusions

The reaction of berries against high pressure is an activation of plant pectin methylesterase enabling homogalacturonan to form pectin gels via calcium ions. This strengthens the cell wall and causes stronger pectin gels after mashing when compared to the untreated berry mash. This stronger pectin gel influences the pressing properties of the mash causing a lower juice yield.

To use high pressure treatment as a powerful tool in juice processing, the next step is to investigate the effect of commercial enzymes in combination with HPP on cell wall polysaccharides and juice yield.

References

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