EFFECT OF HIGH PRESSURE TREATMENT AND ENZYMES ON BILBERRY JUICE EXTRACTION

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Bilberries (Vaccinium myrtillus L.) are excellent sources of bioactive components, such as anthocyanins. In juice processing, a significant amount of these health promoting compounds are left in the press cake. In order to increase the amount of phenolic compounds in the juice and to increase juice yields, the potential of new processing methods are evaluated in an ongoing project. High pressure processing is an interesting technology due to its plant cell membrane permeabilizing action (1, 2) and its ability to alter the activities of cell wall degrading enzymes (3).

MATERIALS AND METHODS

Frozen bilberries of Finnish origin were used in the study. The berries were treated by four different procedures before juice extraction, as shown in Figure 1. The commercial enzyme preparation, Biopectinase CCM (Quest Int.), that was used in this study was dosed according to its polygalacturonase activity at pH 5 (53170 nkat/ml). The high pressure treatments were performed in a laboratory scale high pressure unit (HPIU-10000-AT, Resato International, The Netherlands), equipped with six cylindrical vessels with a volume of about 60 ml each (∅ 25 mm). The juice was extracted from the treated mash by a juice pressing device, which was attched to a Texture Analyser (TA-HDi, Stable Micro Systems LTd., UK). The phenolic content of the centrifuged juice was determined by the Folin-Ciocalteu method.

Table 1. *Total phenolic content of juices obtained after different treatments of mash before pressing.*

Treatment	Pressure (MPa)	Total phenolic content of juice (mg/L)
None	0,1	3356, 2870
Enzyme	0,1	4143, 3877, 3450
Pressure	200	2909
Pressure with enzyme	50 200 600	2572 2464 2291
Pressure before enzyme	50 200 400 550	3618, 3535 3763, 3717 3421 3227
Pressure after enzyme	200	3789

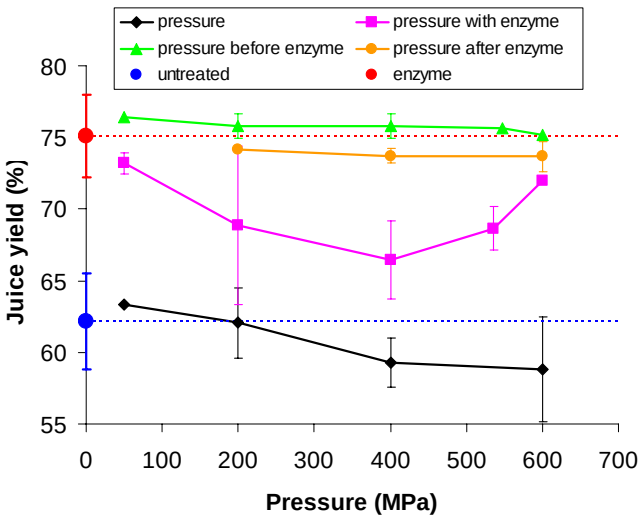

Figure 2. *Juice yields after different treatments of bilberry mash (enzyme = enzyme containing mash incubated for 2 h at 45°C, untreated = pressed directly after mashing).*

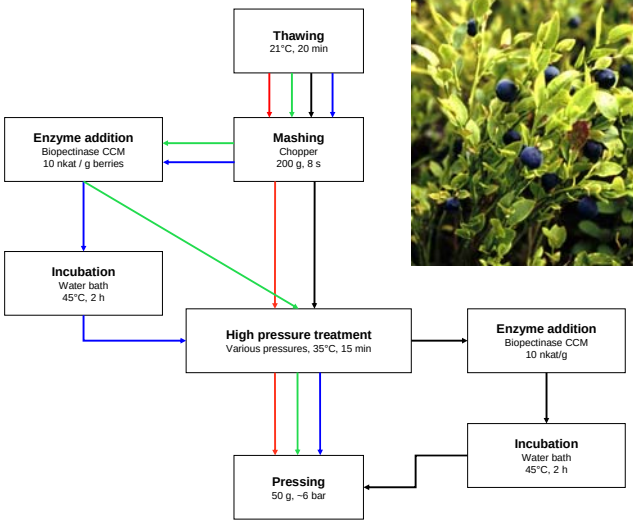

Figure 1*. A schematic diagram of the juice extraction procedures investigated in this study.*

RESULTS

When the mashed bilberries were only high pressure treated before juice pressing, no increase in juice yield or total phenolic content (TPC) was observed in comparison to the untreated mash (Figure 2, Table 1). The enzyme treatment was most effective when it was performed at atmospheric pressure. Enzyme treatment at high pressure resulted in no improvement in juice yield and the TPC of the juice was remarkably low, especially at the highest pressures tested. High pressure treatment either before or after enzyme treatment at atmospheric pressure did not result in significant increases in juice yield or TPC.

CONCLUSION

The reduced juice yields after high pressure treatment may be a result of increased release of pectin from the berry matrix to the liquid phase of the mash. More pectin with a low degree of methylation is probably available for gelling with calcium ions after pressure treatment, since the activities of the endogenous and added pectin degrading enzymes polygalacturonase (PG) and pectin methylesterase (PME) are influenced by the application of high pressure. PG is according to literature easily inactivated at moderate pressures, while PME is much more pressure resistant. The reason for the reduced TPC of juice may be activation of the polyphenoloxidase (PPO) enzyme naturally present in the berries.

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