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COMBINING POWER ULTRASOUND WITH ENZYMES IN BERRY JUICE PROCESSING

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INTRODUCTION

Enzymes are widely used in juice processing. The main purpose is to disrupt the cell wall network and enhance the juice yield. Disruption of the network releases also cell wall matrix components, such as phenolic compounds into juice. However, in current juice processing, a significant amount of phenolics 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 being evaluated in ongoing EU-project. Power ultrasound (US) is an interesting technology as it is known to accelerate extraction processes of plant materials. The mechanical effects of ultrasound can provide greater penetration of solvent into the plant tissue and improve mass transfer. Ultrasonic waves generating cavitation can disrupt cell walls to facilitate the release of matrix components. The combined effect of pectinases and US treatment on juice yield and extractability of phenolic compounds from bilberries and black currants was studied.

MATERIALS AND METHODS

Frozen bilberries (*Vaccinium myrtillus*) and black currants (*Ribes nigrum*) were used in the study. US treatment was performed after enzyme incubation. Commercial enzyme preparations, Pectinex BE 3-L for bilberries and Biopectinase CCM for black currants, were used. The enzymes were dosed as endopolygalacturonase activity measured at pH 3.5, and two enzyme dosages, 100 nkat/g and 1000 nkat/g of berries, were used. The power ultrasound treatment was performed in a laboratory scale equipment manufactured by Dr. Hieshler GmbH (Germany, power 2000 W (60 W/cm2), frequency 20 kHz). Efficiency of the treatment (amplitude 100%, treatment time 3 min 15 s) was chosen on the basis of preliminary studies. Juice was extracted from the treated mash by a juice pressing device, which was attached to Texture Analyzer (TA-HDi, Stable Micro systems LTd., UK). The phenolic concentration of the centrifuged juice was determined fy the Folin-Ciocalteu method.

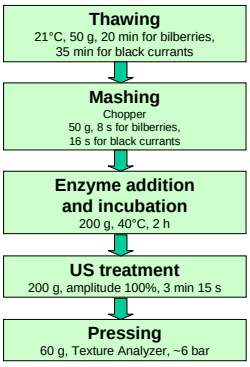

Figure 1. *A schematic diagram of the juice extraction procedure investigated in this study.*

RESULTS

Bilberry

US did not improve the juice yield with either of the enzyme levels. However, at the lower enzyme level, US treatment increased the concentration of phenolic compounds of bilberry juice by more than 15 %, and at the higher enzyme level it slightly decreased the concentration. The same level of total phenolics was achieved by either 100 nkat/g of enzymes combined to US or 1000 nkat/g of enzymes only (Figure 2).

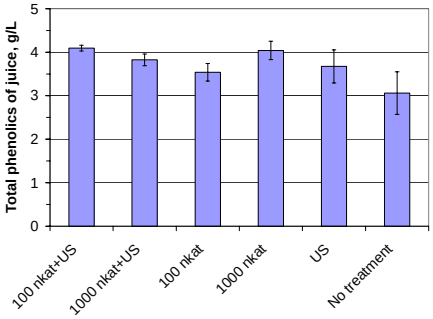

Figure 2. Total phenolic concentration of bilberry juices (mean value of two experiments) obtained after different treatments.

Black currant

Influence of US was more significant with black currants which are more challenging berries in juice pressing than bilberries due to their high content of pectin and different cell wall architecture. Although the influence on juice yield was not remarkable, max. 6%, the concentration of phenolic compounds in the juice increased by 15-25% by using US treatment after enzyme incubation. The highest level of total phenolics was achieved by combining US to high level of enzymes (Figure 3).

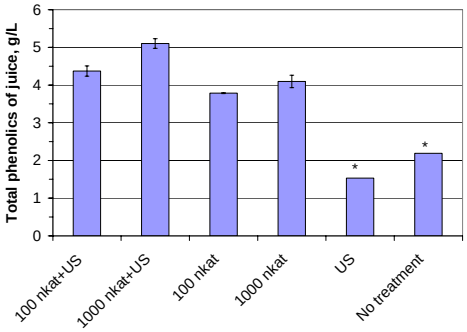

Figure 3. Total phenolic concentration of black currant juices (mean value of two experiments, * only one experiment) obtained after different treatments.

CONCLUSION

The results indicate the potential of power ultrasound in juice processing. US might have potential in intensifying the effects of enzyme treatment, and hence reduce the amount of enzyme needed or increasing the yield of extractable health-relevant compounds.

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