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Separation of monoglucosides from fruit juice by diafiltration

Introduction

Anthocyanins, a group of compounds responsible for the violet colours of many fruits and berries, have industrial application as natural food colorants. In this study black currants has been investigated as an alternative source.

Objective

It has been the objective of this study to purify the anthocyanins of black currant juice (1-2 g/l) for the natural content of fructose and glucose (30-40 g/l).

Theory

Monoglucosides in black currant juice limit the application as a source of anthocyanins due to the risk of unwanted effects in the end products. The four anthocyanins in black currant are the glucosides and rutosides of delphinidin og cyanidin (fig. 1).

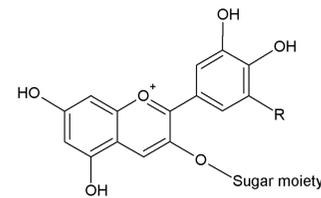


Figure 1: Structure of anthocyanins in black currant juice. R = -H for delphinidin and R = -OH for cyanidin.

As the concentration of every solute is never larger in the permeate than in the retentate, the feed concentration increase during recirculation of the retentate. This will increase the osmotic pressure and reduce the effective pressure difference driving the process. The osmotic pressure can be kept down by addition of pure water to the feed. This flushing process is known as diafiltration.

Experimental setup

The experiments were conducted on both lab scale (0.25 m²) and pilot plant (6.1 m²) equipment (fig. 2 and 3 resp.).



Figure 2: Photograph of lab scale facility.



Figure 3: Photograph of pilot plant facility.

The feed tank was initially filled with single strength black currant juice and the feed was pumped through the membrane module. Permeate was continuously withdrawn from the system, while the retentate was recirculated to the feed tank. (fig. 4)

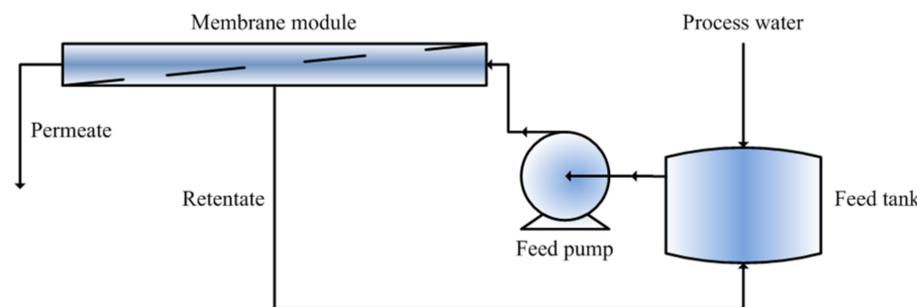


Figure 4: Photograph of pilot plant facility.

Results and Discussion

More than 90% of anthocyanins were retained in the feed, whereas only 20-30 % of fructose and glucose were retained by the membrane (fig. 5). Hence these monosaccharides were gradually flushed out of the anthocyanin solution.

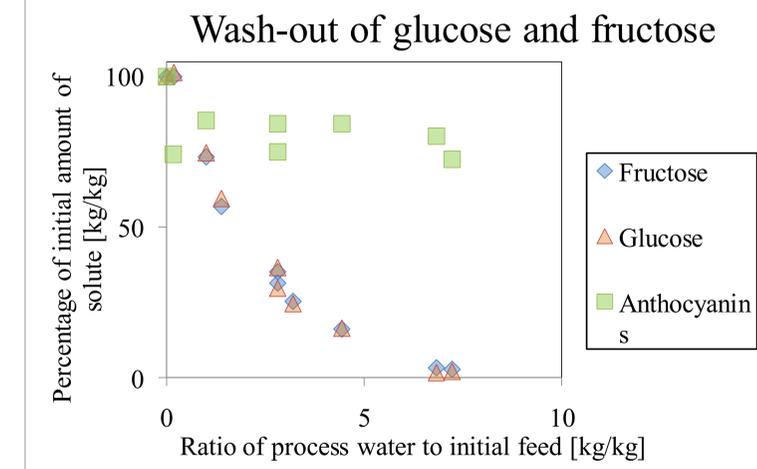


Figure 5: Gradual washing out of fructose and glucose

Conclusion

The experiments showed that nanodiafiltration can be applied for the removal of glucose and fructose from black currant juice as a method for purification of anthocyanin colorants. In addition it was shown that the process could be performed in commercial size spiral wound membrane modules (4”).

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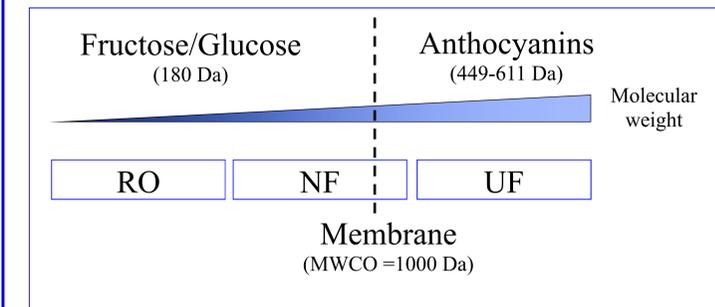


Figure 6: Overview of the separation principle

Literature

Jensen, M.B.; Christensen, K.V.; Norddahl, B.; 2009; Purification of Flavonoids from Black Currant Juice by Nanodiafiltration; Euromembrane 2009, Abstracts; Société OSC, s. 164-165

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