Innovating approach of crossflow microfiltration to obtain citrus extracts concentrated in bioactive compounds

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This study was investigated to perform an innovating approach which consisted in the use of crossflow microfiltration to produce *Citrus Clementina* concentrates extracts. In order to promote his nutritional potential, the aim of this work was to obtain a citrus concentrate enriched between 6 and 8 fold in bioactive compounds such as carotenoids and flavonoids.

To carry out this study, a laboratory scale microfiltration pilot with four identical membranes connected in series had been used [1]. Membrane chosen were mono-tubular 55 cm² ceramic membranes of 0,2 µm pores diameters (PALL, New York, USA). Transmembrane pressure was set to an average system pressure of 3 bars and temperature was controlled to remain a range of 28 – 32 °C. The trial followed two classical steps; in the first place a constant feed of juice caused a slow increase of Mass Reduction Ratio (MRR); in a second time a concentration without alimentation led to a high increase of MRR. The products selected were a pasteurized commercial juice with pulp bought from a local market and a housemade juice made with a juice extractor.

A final extract of clementine concentrated 7 fold had been produced for each juice. For commercial retentate, Insoluble Solids Suspension (ISS) were also concentrate 7 fold while housemade retentate ISS was only concentrated 6 fold. Those juices showed two particles diameters profile with highest particle size distribution for the commercial juice which presented also more fouling. This distribution affected permeate flows and obviously retentions with average process flux of 56 $Kg.h^{-1}.m^2$ for commercial juice and 72 $Kg.h^{-1}.m^2$ for housemade one. As expected, 0.2 µm pore diameters didn't retain simple sugars (fructose, glucose and sucrose) or organic acid as vitamin C.

The concentration factors (CF) obtained for β-cryptoxanthin, the major pro-vitamin A carotenoid from clementine juice, were 7,41 (1,51) for commercial retentate and 6,41 (1,72) for housemade retentate. Hesperidin, the main flavanone glycoside of clementine, had been retain in the same range with a final CF of 7,31 (0,11) for commercial concentrate and 8,24 (0,91) for housemade concentrate. Those results suggest that the liposoluble fraction were fully retained with the pulp (ISS) while hydrosoluble compounds were not retained. It is interesting to note that the polar character of the membrane didn't explain entirely this phenomenon since compounds with an average polarity such as Narirutin, a minor flavonoid, had been concentrate 3 times for commercial retentate and 5 times for housemade retentate.

Sampling preparation of the same fruit had a significant impact on both flux and retention and lead to different bioactive retentate. Those results bring a new vision on dietary products processed by membrane technologies improving knowledge on green process to produce fresh food-based fruit concentrate.

Keywords: Crossflow microfiltration; Clementine; Concentration; Carotenoids; Flavonoids

References

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