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PB49 – CONCENTRATION OF WATERMELON JUICE BY REVERSE OSMOSIS PROCESS

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INTRODUCTION: Recent studies have reported an inverse relationship between the consumption of fruits with the incidence of several degenerative diseases Watermelon is a tropical fruit with excellent flavour, color, sweetness and succulence. Nowadays it is pointed out as an excellent source of lycopene, a carotenoid with antioxidant property which is thought to have a protective effect against the risk of cancer (1). To increase your marketing potential the watermelon may be processed either as a fresh single strength or as a concentrated juice. Membrane separation processes are conducted at low temperatures maintaining the quality of the final product. They have been suggested for the processing of fruit juices for their preservation and concentration. The aim of this work was to study reverse osmosis processes to concentrate fresh watermelon juice evaluating its effect on lycopene content and consequently on the antioxidant capacity of the concentrated juice.

MATERIALS AND METHODS: The juice was obtained by the depulping of the fruits in a finisher with a 0.8 mm. The juice samples were conditioned in polyethylene - aluminum bags and stored at -18°C until their use. Reverse osmosis was carried out a pilot plant unit with polyamide composite membranes conditioned in a plate and frame module, totalizing a permeate area of 0.72m^2. It was used composite membrane of polyamide / polysulphone from DSS – Denmark, presenting 98% NaCl rejection at 25°C and 60bar. The processes were carried out in a fed batch system at 30°C, 60 bar transmembrane pressure and 650 L/h flow rate. The permeate flux was measured every 15 minutes by volume of permete during a determined period of time. Samples of the watermelon juice (F) and of the retentate (R) fractions were analyzed for pH, soluble solids content (°Brix) and total titrable acidity (g/100g) according to AOAC (2). Lycopene content was determined by extraction with hexane measured in ByoSistem spectrophotometer at 503 nm (3). Antioxidant capacity was evaluated by extraction with hexane followed by the quantification using ABTS radical and Trolox as standard (4). The color loss was determined in spectrophotometer at 734nm after 15 min of reaction of the sample with the ABTS radical. All the samples were analyzed in triplicate. Analysis of variance (ANOVA) was used to compare the means. Differences were considered to be significant at $p < 0.05$. The statistical analyses were performed with XLSTAT.

RESULTS: Figure 1 shows the permeate flux behavior of the processes. The average initial permeate flux was 44.3 ± 3.1 L.h-1.m-^{2}. After 10 min, a reduction of 58% in the permeate fluxes was observed reaching an average permeate flux of 21.7 ± 5.1 L.h-1.m-^{2}. The volumetric concentration factor obtained was 4.4 ± 0.3. The observed increase in the permeate flux was due to the addition of raw juice in the feed tank. The concentrated juice reached 30° Brix, corresponding to a concentration factor of 3.6. The lycopene content and antioxidant capacity increased, respectively, 3.2 and 2.4 folds in relation to the single strength juice. These observed losses could be due the oxidation and isomerization reactions of lycopene during the processes, which affect directly the antioxidant capacity. The increased of the total soluble solids content (°Brix) during the processes is shown in Figure 2. Lycopene content and antioxidant capacity increased, but in a slightly smaller proportion than the concentration factor of soluble solids (Table 1).

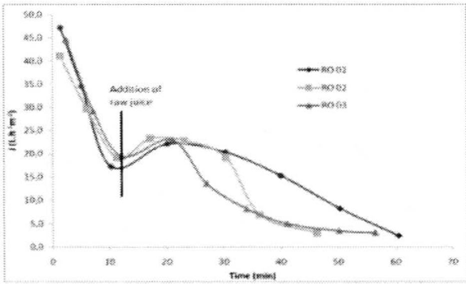

Figure 1: Permeate flux variation during the concentration of watermelon juice by reverse osmosis processes.

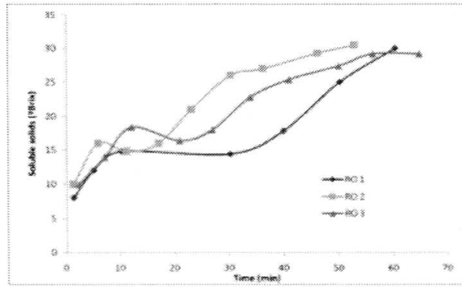

Figure 2: Soluble solids content during the concentration of watermelon juice by reverse osmosis processes.

Table 1: Caracterization of the feed and retentate fractions

Analysis	Raw juice	Concentrated juice
pH	5.43 [a] ± 0.13	5.22 [a] ± 0.03
Soluble solids (° Brix)	8.3 [a] ± 0.3	29.9 [b] ± 0.7
Total titrable acidity (g/100g)	1.21 [a] ± 0.26	3.55 [b] ± 0.16
Total solids (g/100g)	7.07 [a] ± 0.01	29.6 [b] ± 2.11
Lycopene (μg/g)	31.43[a] ± 6.49	100.87[b] ± 29.77
Antioxidant Capacity (μmol Trolox/g)	0.34[a] ± 0.06	0.81[b] ± 0.14

Same lettes in the same line do not differ significantly ($p > 0.05$) among themselves by Tukey test.

CONCLUSIONS: The results showed that it was possible to concentrate watermelon juice by reverse osmosis process.

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