233-02. Concentration of Apple Juice by Membrane Separation Processes

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Apple is a fruit rich in phenolic compounds, which are important to the human diet due to the high antioxidant capacity. Membrane technologies, as microfiltration (MF), reverse osmosis (RO), and osmotic evaporation (OE) have been evaluated as alternatives to the conventional clarification and concentration of fruit juices. This study aimed at to evaluate the final quality of apple juice clarified and concentrated by microfiltration, reverse osmosis, and osmotic evaporation. The clarification was performed by microfiltration at 30 °C and 2 bar, using a ceramic membrane of 0.1 µm pore size of and 0.022 m2 of permeation surface. The juice concentration was carried out in 2 steps. The juice was pre-concentrated by reverse osmosis and then this juice was concentrated by osmotic evaporation. Reverse osmosis was carried out at 30 °C and 60 bar in a plate and frame unit with composite membranes presenting 98% rejection to NaCl at 30 °C and 60 bar. The osmotic evaporation trials were carried out in a lab scale system composed of 2 independent closed circuits, one for the juice and the other for the brine, using a PFTE 0.2 µm flat sheet membrane. A solution of CaCl2 5.5 M was used as brine. Samples were analyzed regarding phenolic concentration and antioxidant activity by the Folin-Ciocateau spectrophotometric method and free radical ABTS● method, respectively. Regarding RO, the initial permeate flux was around 40 L/hm2. The maximum volumetric concentration factor (VCF) was 3.5 when the juice reached 28 °Brix. The juice with 28 °Brix was then concentrated by OE. The evaporatory flux ranged from 5.5 kg/hm2 to 1.5 kg/hm2 and the concentration of the juice reached up to 50 °Brix. The phenolic content and antioxidant activity increased proportional of the VCF. These results indicate the potential of coupling reverse osmosis and osmotic evaporation to concentrate fruit juices.