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OPTIMIZATION OF EXTRACTION AND CONCENTRATION OF ANTHOCYANINS FROM ROSELLE (HIBISCUS SABDARIFFA L.) BY AQUEOUS EXTRACTION AND NANOFILTRATION

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To prepare roselle extract, dried calyces of *Hibiscus sabdariffa* cultivar CLT 92 from Senegal, were mixed with plain water. To optimize the aqueous extraction of anthocyanins from Roselle calyces, five ratios calyces/water (kg/kg) were studied (1/5, 1/10, 1/15, 1/20, 1/25). By identifying the effect of various operative parameters, we found that an appropriate sieve of the calyces and the extraction temperature improved both the kinetics and yield of extraction of anthocyanins from Roselle calyces. By studying extraction kinetics, we identified and quantified the effective diffusivity, which ranged from 1.71 and to $4.10 \times 10^{-11} \text{ m}^2 \cdot \text{s}^{-1}$ and the yield of extraction of anthocyanins from Roselle calyces were between 67 and 74 % at extraction temperatures between 25 and 40 ° C. The ratio 1/5 with an extraction yield of 72 % at 35 ° C was selected to produce the Roselle extract to be concentrated.

The aqueous extract obtained is characterized by a high content of anthocyanins (1.5 g/100 g DM), high acidity (14 meq/100g) and low sugar content (2.9 g/100g). This extract is enriched in anthocyanins by nanofiltration using a laboratory pilot of 133 cm². Membranes from three different suppliers and with similar cut-off thresholds (200-500 Da) were tested: NF270 Dow, GE Osmonics DL and Nadir NP030. Permeate flux and physico-chemical characteristics were determined for each membrane by varying the transmembrane pressure from 5 to 20 bar. The flux densities were ranging between 1 and 37 kg.h⁻¹.m⁻². DL membrane from GE Osmonics brand presents the best permeate flux at 20 bar (37 kg.h⁻¹.m⁻²). All the membranes have retention rates in anthocyanins between 92 and 100 %. The membrane Nadir NP030 shows the least important retention rate in anthocyanins to 20 bar (97 %). These results were validated on a semi-industrial nanofiltration pilot featured with a membrane DL of 2.5 m². The nanofiltration permitted to concentrate the roselle extract to 50 and 250 g kg⁻¹ of total soluble solids with a volumetric reduction ratio (VRR) of 4 and an average permeate flux of 20 kg.h⁻¹.m⁻² at a transmembrane pressure of 20 bar and a temperature of 30 ° C.

Keywords : *Hibiscus sabdariffa*, anthocyanins, extraction, nanofiltration, diffusivity