

“Recovery of phenolic compounds from nixtamalization wastewaters using a narrow membrane (1 kDa)”

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The Nixtamalization wastewaters (NWs) are a by-product of food processing industry. The extract is produced from maize processing industry by a common Nixtamalization process applied to maize as pretreatment in order to have more manageability of the grains during their post processing. This wastewater is rich in valuable components as polyphenols, hydrolyzed parts of the grain as well as calcium hydroxide added during the pretreatment. There is strong evidence that NWs collaborate to the environmental pollution due to its high chemical composition. The aim of this study was to evaluate a membrane process as ultrafiltration using a narrow membrane (1 kDa) to recover high added value compounds as well as avoid the water and environmental pollution by effluent. Before the processing of 1 kDa membrane, the NWs were clarified by ultrafiltration using 100 kDa membrane.

The NWs were analyzed in terms of total soluble solids (TSS) (0.80 ± 0.0 °Bx), total solids content (TSC) ($0.79 \pm 0.0\%$), turbidity ($5.44 \pm 0.84\%$), pH (13.37 ± 0.0), density (987.81 ± 0.80 g/L), electrical conductivity ($1558.33 \pm \mu\text{S/cm}$), carbohydrates (1.08 ± 0.0 mg/mL), polyphenols (970.37 ± 16.03 mg/L), total organic carbon (TOC) (1908.48 ± 0.35 mg/L) and calcium content (814.80 ± 5.26 mg/L). The extract was processed in recirculation mode at different transmembrane pressures (TMP) (69,103,138 and 172 kPa) in order to find the optimal TMP for carrying out the separation of NWs in batch concentration configuration. The operating conditions to separate NWs in batch concentration configuration were at TMP (172 kPa), feed flow rate 58 L/h and temperature 25 °C. The narrow membrane (1 kDa) presented high retention values (R_i) on TSS (100%), TSC (77.58%), carbohydrates (75.77%), turbidity (30.76 %) and TOC (79.98 %); however, the membrane presented low retention (1.90 %) in polyphenols.

After membrane separation process, two valuable fractions were produced: A clear fraction rich in polyphenols (951.85 ± 6.99 mg/L) was obtained, this fraction presented low organic load in terms of TOC (381.99 ± 0.03 mg/L). In case of phenolic enriched-fraction, it can be used in food, pharmaceutical and biotechnological applications due to their biological activities. On the other hand, the calcium was concentrated in retentate fraction (3155.3 ± 5.24 mg/L), this stream can be reused in following nixtamalization processes as calcium hydroxide in solution. Finally, the recovery of chemical components by membrane technology is a real approach to the treatment of food wastewaters as well as seems to be a valid tool on food industry for processing of aqueous systems. In addition, the fractionation of NWs using a narrow membrane supports the contribution to avoid the environmental pollution by food wastes.

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