

Progressive Freeze Concentration of Coconut Water Using a Simple Cylindrical Apparatus

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Abstract

There is a growing global demand for coconut water as a beverage due to its health benefits rather than artificial drinks. Most of the concentration techniques operate on a temperature around or above room-temperature. This will lead to the deterioration of the original quality of the liquid. Freeze concentration (FC) is the most suitable method for coconut water over evaporation and membrane concentration methods since FC operates below 0°C. Suspension Freeze Concentration (SFC) and Progressive Freeze Concentration (PFC) are the available FC methods. SFC is a complex and expensive method compared to PFC which requires a high investment cost. PFC is a novel freeze concentration method using a simple apparatus which removes water molecules from the liquid by attaching to the progressively growing single ice front. At proper operating conditions with a low crystal growth rate, the concentration efficiency is high. The objective of the present study was to develop a PFC method for the high-quality concentration of coconut water. A simple cylindrical apparatus was used for PFC which consists of a sample vessel, agitator system, and a cooling bath (Ethylene glycol/Water). Optimum operating conditions of the apparatus were found using standard sucrose solutions. The final concentration of the liquid product was directly affected by the agitator speed and sample vessel dipping speed. PFC agitator speed of 290 rpm and dipping speed of 1.3cmh⁻¹ were reported as the optimum operating conditions to achieve the highest concentration for the used PFC apparatus in the present study. Using optimized agitation speed and dipping speed, coconut water was concentrated up to Brix 8.5° from the initial concentration of Brix 3.5°. The total yield (based on brix) of the Progressive freeze concentrated coconut water was 0.669 ± 0.10 (67%).

Keywords: Coconut water, Freeze concentration, Progressive freeze concentration, Simple cylindrical apparatus, Suspension freeze concentration

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