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**QUANTITATIVE STUDY OF ESTER RECOVERY DURING THE
CONCENTRATION OF CASHEW APPLE (ANACARDIUM
OCCIDENTALE L) JUICE IN A THERMAL-SIPHON TYPE
EVAPORATOR OPERATING IN A CLOSED SYSTEM**

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During the concentration of cashew apple juice, the esters, one of the most important chemical classes contributing to beverage aroma and flavour, are lost by evaporation, reducing the sensory quality of the concentrate (1). These volatiles can be recovered by condensation and subsequently added back to the processed juice, improving its sensory quality. Hence a qualitative and quantitative knowledge of the evaporation and recovery of the esters during juice concentration, as yet little studied, is fundamental. The objectives of the present research were to identify and quantify the loss and recovery of esters during the different steps of cashew apple juice concentration. Three and a half litres of fresh juice were concentrated in a thermal-siphon type evaporator at 35°C, operating in a closed system under vacuum (700mmHg), condensation occurring at 2°C. Two condensates were produced: one containing volatiles recovered during concentration from 10.6 °Brix (fresh juice) to 12 °Brix, and the other during concentration from 10.6 °Brix (fresh juice) to 40 °Brix. The volatiles in the headspaces of the condensates were stripped by vacuum (70mmHg) to a Porapak Q trap during 2h, eluted with 300 µl of acetone, identified by GC-MS and quantified by external standardization using 12 standards representing the following chemical classes: esters, aldehydes, alcohols, ketones, terpenes, acids, lactones and sulphur compounds. The odoriferous importance of the isolated volatiles was assessed by GC-olfatometry using the Osme technique (2). A total of 581.28 mL condensate was recovered during concentration from 10.6 to 12.1 °Brix, and 2307.14 mL from 10.6 to 40 °Brix. The first condensate contained 580.31µg/L of esters, representing 90% of the total mass of volatiles present in the *sample*. The esters ethyl hexanoate (158.45µg/L), ethyl isovalerate (137.47µg/L), ethyl crotonate (89.34µg/L), ethyl butanoate (52.49µg/L), ethyl 2-methylbutanoate (31.57µg/L), ethyl propanoate (30.59µg/L) and isoamyl acetate (14.03µg/L), together represented 80% of the total mass of volatiles recovered in the first condensate. Twenty-nine odiferous volatiles were identified in this condensate by GC-olfactometry (Osme), of which 21 were esters, the following showing the greatest odour impact: ethyl crotonate (cashew), ethyl butanoate (cashew), ethyl isovalerate (fruit/sweet), ethyl hexanoate (fruit/floral), ethyl 2-methylbutanoate (cashew/strawberry), propyl acetate (sweet/fruit), methyl 3-methylpentanoate (sweet/grassy), 2-methylpropyl acetate (fruit/grassy), ethyl octanoate (grainy/mould) and methyl 2-methylbutanoate (fruit/cashew). The condensate obtained



during concentration from 10.6 °Brix to 40 °Brix contained 46µg/L esters, also representing about 90% of the total mass of volatiles present in the sample. All the esters were present at much lower concentrations than in the first condensate, including those of greater odoriferous importance, such as ethyl crotonate (5.64µg/L), ethyl butanoate (4.62 µg/L) and ethyl isovalerate (14.28µg/L). The results indicated that the esters represented the major class of volatiles recovered in the condensate during cashew apple juice concentration. It appears that the majority of the esters present in the cashew apple juice evaporated at the beginning of concentration, suggesting that the recovery of volatiles during the rest of the process only dilutes the material, without significantly altering the quantitative and qualitative profiles of the esters present in the final condensate.

References:

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