

FREEZE CONCENTRATION PROCESS: A POTENTIAL TO ENHANCEMENT THE PHENOLIC COMPOUNDS IN APPLE JUICES

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Apple juice is the second most consumed and produced juice in the World, aside from orange juice. Their consumption has been reported in the literature because of their health benefits, provided mainly by phenolic compounds. In order to facilitate and ensuring the preservation, further to reduce costs of transport and storage the concentration process it is commonly used by juice industry. This unit operation could be made by evaporation, membrane technology, and freeze concentration (cryoconcentration). Cryoconcentration is a method for recovering a food solute from a solution based on the separation of pure ice crystals from a freeze-concentrated aqueous phase. Furthermore, there are not lost of the functional properties in the juices, because it is not applied heat. Thus, the aim this work was to verify the influence of the freeze concentration process to enhancement the antioxidants compounds in apple juices. Firstly, apple juice from Red Delicious and Granny Smith variety were produced in laboratory scale and concentrated by block freeze concentration method in three steps. The levels of the phenolics determined by HPLC and spectrophotometer increased significantly ($p < 0.05$), with each freeze concentration cycle that was developed to concentrate the apple juices. Besides that, the process showed an average increase in the phenolics evaluated of 1.9 times for the first step of the concentration, and 2.89 and 3.80 times to second and third steps, respectively. Between the varieties, Granny Smith juices showed higher levels of individual flavan-3-ols (catechin and epicatechin) and quercetin glycosides (flavonols), while Red Delicious samples had higher levels of chlorogenic acid and phloridzin. As reported to phenolics, the antioxidant potential evaluated by radical scavenging activity (DPPH and ABTS assays) and reduction power (FRAP and CUPRAC assay) also increased with cryoconcentration cycles applied. In apple juices the antioxidant properties is directly associated with the phenolic composition. Which, the influence of the phenolics in the *in vitro* antioxidant activity was confirmed by significant correlation ($p < 0.05$) between the antioxidant assays and total phenolics, flavonoids, flavan-3-ols, and flavonols ($r > 0.70$). However, the increase

in the antioxidant activity might be attributed to the increase in the phenolic compound in the apple juices because of the concentration process. Thus, the use of apple juice concentrate by freeze concentration can be an excellent product to improve functional properties in juices, jams, fermented, smoothies, etc.

Palavras-chave: cryoconcentration, antioxidants, functional properties, HPLC