A Novel Alternative Method in Production of Fruit Juice Concentrate: Ohmic Heating Assisted Vacuum Evaporation

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Evaporation process is the one of the main processes used in the preservation of the food products. By removing the amount of water present in the product during evaporation, some purposes such as providing the microbiologically safer product, reducing the cost of transportation and the storage area. In the food industry, evaporation process is conducted thermally under vacuum. Since it results in some quality losses and the formation of undesired components alternative techniques have been investigated in recent years. The application of novel techniques such as freeze concentration and membrane concentration is limited since they have the high capital cost and fail to achieve the desired water soluble dry matter.
In this study, evaporation process was achieved by integration of ohmic heating system into a vacuum system. Ohmic heating assisted vacuum evaporation (OVE) was applied in 3 different voltage gradients (10,12, and 14 V/cm) at 65°C. The food material was chosen as cherry juice having an important economic value for Turkey. The sour cherry juice having total soluble solid content (TSSC) of 19.2% was concentrated to 65% TSSC content. Total phenolic content (TFC) and total monomeric anthocyanin (TMA) content were determined by using Colin-Folin reagent and pH differential methods, respectively. The results were compared with those of concentrated cherry juice obtained by vacuum evaporation (VE) in the same system. SPSS 16.0 package program was used for statistical evaluation of the results. Differences between the effects of the treatments were determined by one-way variance (Post Hoc-Duncan test) analysis, according to the Completely Randomized Design.
Total phenolic content of unprocessed sour cherry juice (raw material) was determined to be 2617.63 mg/L as Gallic acid. TFC of sour cherry concentrates having TSSC of 65% obtained from OVE and VE processes were statistically different from the TFC of raw material ($p<0.05$). For better comparisons of the effects of processes, the data was arranged on dry matter basis taking into account the total solid contents, and the TFC was determined to be varied between 12179.72-13911.15 mg/L. The highest TFC was obtained in the OVE process applied at a voltage gradient of 14 V/cm while the lowest was obtained in the VE process. It was determined that the TFC of the samples treated by the OVE treatments applied at voltage gradients of 14 V/cm and 12 V/cm were similar to raw material.
On the other hand, it was determined that the TMA contents of juice concentrates were statistically different from the raw material ($p<0.05$). TMA content of the sour juice having TSSC of 19.2% was found as 518.78±18.26 mg/L (Cyn-3-glu) while it was determined as 1777-1561.67 mg/L after the evaporation process. In dry basis, TMA content was 2701.97±95.11 mg/L while it was in the range of 2422.28-2717.71 mg/L after evaporation. When OVE applications were compared within themselves, it was determined that 14 V/cm was different from other applications but there was no statistically significant difference with raw material.
As a result, concentrated sour juice production was successfully achieved by the OVE system, and the changes of TFC and TMA contents of the sour juice concentrated by OVE and VE

methods were investigated. It was found that the highest change (loss) in TFC and TMA contents was determined for VAE application. In the application of 14 V/cm, TFC and TMA contents were similar to those of raw material. In other words, TFM and TMA contents were preserved more by OVE process than VE process since its thermal effect was lesser. This demonstrates that OVE process could be used as an alternative technique to VE process.

Keywords: Cherry juice, evaporation, ohmic, vacuum