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Moderate Electric Field and Ultrasound as Alternative Technologies to Raspberry Juice Pasteurization Process

Authors : Cibele F. Oliveira, Debora P. Jaeschke, Rodrigo R. Laurino, Amanda R. Andrade, Ligia D. F. Marczak

Abstract : Raspberry is well-known as a good source of phenolic compounds, mainly anthocyanin. Some studies pointed out the importance of these bioactive compounds consumption, which is related to the decrease of the risk of cancer and cardiovascular diseases. The most consumed raspberry products are juices, yogurts, ice creams and jellies and, to ensure the safety of these products, raspberry is commonly pasteurized, for enzyme and microorganisms inactivation. Despite being efficient, the pasteurization process can lead to degradation reactions of the bioactive compounds, decreasing the products healthy benefits. Therefore, the aim of the present work was to evaluate moderate electric field (MEF) and ultrasound (US) technologies application on the pasteurization process of raspberry juice and compare the results with conventional pasteurization process. For this, phenolic compounds, anthocyanin content and physical-chemical parameters (pH, color changes, titratable acidity) of the juice were evaluated before and after the treatments. Moreover, microbiological analyses of aerobic mesophiles microorganisms, molds and yeast were performed in the samples before and after the treatments, to verify the potential of these technologies to inactivate microorganisms. All the pasteurization processes were performed in triplicate for 10 min, using a cylindrical Pyrex® vessel with a water jacket. The conventional pasteurization was performed at 90 °C using a hot water bath connected to the extraction cell. The US assisted pasteurization was performed using 423 and 508 W cm-2 (75 and 90 % of ultrasound intensity). It is important to mention that during US application the temperature was kept below 35 °C; for this, the water jacket of the extraction cell was connected to a water bath with cold water. MEF assisted pasteurization experiments were performed similarly to US experiments, using 25 and 50 V. Control experiments were performed at the maximum temperature of US and MEF experiments (35 °C) to evaluate only the effect of the aforementioned technologies on the pasteurization. The results showed that phenolic compounds concentration in the juice was not affected by US and MEF application. However, it was observed that the US assisted pasteurization, performed at the highest intensity, decreased anthocyanin content in 33 % (compared to in natura juice). This result was possibly due to the cavitation phenomena, which can lead to free radicals formation and accumulation on the medium; these radicals can react with anthocyanin decreasing the content of these antioxidant compounds in the juice. Physical-chemical parameters did not present statistical differences for samples before and after the treatments. Microbiological analyses results showed that all the pasteurization treatments decreased the microorganism content in two logarithmic cycles. However, as values were lower than 1000 CFU mL-1 it was not possible to verify the efficacy of each treatment. Thus, MEF and US were considered as potential alternative technologies for pasteurization process, once in the right conditions the application of the technologies decreased microorganism content in the juice and did not affected phenolic and anthocyanin content, as well as physical-chemical parameters. However, more studies are needed regarding the influence of MEF and US processes on microorganisms' inactivation.

Keywords : MEF, microorganism inactivation, anthocyanin, phenolic compounds
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