IMPACT OF GRAPEFRUIT SEED EXTRACT (GSE) ON BIOACTIVE COMPOUNDS OF ARONIA JUICE DURING HEAT TREATMENT

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Abstract

The quest for sources of antioxidant phenolic compounds has encompassed a wide array of plant materials, including vegetables, fruits, leaves, oilseeds, cereal crops, barks, roots, spices, herbs, and crude plant drugs. Among these, berries stand out for their exceptional phenolic content, particularly flavonoids and phenolic acids, known for their potent antioxidant properties [1]. Black chokeberry (*Aronia melanocarpa*), a valuable fruit crop within the Rose family (*Rosaceae*) and the Apple subfamily (*Pomodieae*) [2], is renowned for its rich composition of bioactive compounds, including anthocyanins, procyanidins, phenolic acids, flavonols, and flavanols [3]. Chokeberries, owing to their astringent taste, undergo various processing methods to yield long-lasting products such as juices, nectars, wines, and liqueurs [4]. In response to increased consumer demand and growing recognition of its nutritional benefits, chokeberry juice has gained popularity among juice manufacturers. The stability of polyphenolic compounds during processing is closely tied to the chosen processing technology [5]. Furthermore, for many years, traditional plant extracts, spices, and culinary herbs have been used to improve flavour and extend the shelf life of food products [6]. Grapefruit seed extract (GSE) is a naturally derived functional substance from the grapefruit plant (*Citrus paradise Macf., Rutaceae*). It has gained significant interest in the realm of food packaging applications because of its robust antioxidant properties and wide-ranging antimicrobial capabilities [7]. Grapefruit primarily contains the flavanones narirutin and naringin, along with their aglycone form, naringenin. These constituents have long been acknowledged as distinctive components of grapefruit. The distribution of phenolic acids indicates that the prominent hydroxycinnamic acids are ferulic and p-coumaric acids. As for hydroxybenzoic acids, vanillic and gallic acids are the primary ones identified [8].

This study was conducted to assess the impact of different concentrations of grapefruit seed extract addition (0%, 1%, 2%, 3%) on the levels of anthocyanins and polyphenols in aronia juice subjected to heat treatment (60°C) at different times (5, 10, 30, 60, 120 min). The investigation included total anthocyanins testing, quantification of Total Phenolic Compounds (TPC), and the Ferric Reducing Ability of Plasma (FRAP) assay. Based on the results, FRAP values peak at 60 minutes, with 2% GSE at 1915.53 ± 217.94 mg/L and 1910.46 ± 376.74 mg/L with 3% GSE at 5 min. In addition, the presence of GSE has varying effects on TAC depending on the time point and concentration. For instance, in the 1% GSE condition, the TAC levels remain high at 60 minutes with 85.67 ± 2.62 mg/l, while in 2% TAC remains relatively stable across different time intervals: 69.08 ± 0.10 mg/l, 73.84 ± 4.33 mg/l, 69.86 ± 0.86 mg/l at 5, 30, 120 min, respectively. This demonstrates the potential of GSE to mitigate the heat-induced decline in anthocyanins. Furthermore, the inclusion of GSE appears to result in higher Total Phenolic Compounds (TPC) levels, particularly with 1% GSE, compared to 2% and 3% GSE. Specifically, TPC levels with 1% GSE were measured at 6608.22 ± 227.75 mg/l, 7518.17 ± 374.66 mg/l, and 6639.81 ± 241.85 mg/l at 10, 60, and 120 minutes, respectively. This suggests a potential enhancement of TPC by GSE, especially in the early stages of heat treatment.

In summary, 1% Grapefruit Seed Extract (GSE) concentration shows promise in preserving the compounds in aronia juice during heat treatment, particularly for Total Antioxidant Capacity (FRAP). For Total Anthocyanins content and Total Phenolic Compounds (TPC), both 1% and 2% GSE concentrations are effective, with a slight advantage for 1% GSE, especially in the early stages of heat treatment. These findings have implications for enhancing the compounds' stability in aronia juice during processing. Further research is needed to explore these effects comprehensively and under different conditions.

Keywords: Black Chokeberry, Aronia, Grapefruit Seed Extract (GSE), Anthocyanins, Polyphenols, TPC, FRAP.

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