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The Effect of Aromatic Plant Extracts Encapsulated in Alginate on the Bioactivity, Textural Characteristics and Shelf Life of Yogurt

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Abstract: The article investigated the antioxidant and antimicrobial activity of extracts from two aromatic plants—*Satureja hortensis* L. (SE) and *Rosmarinus officinalis* L. (RE), encapsulated in alginate, on—yogurt properties. The encapsulation efficiency was controlled by FTIR and SEM analysis. In both extracts, the individual polyphenol content was determined by HPLC–DAD–ESI-MS. The total polyphenol content and the antioxidant activity were spectrophotometrically quantified. The antimicrobial properties of SE and RE against gram-positive bacteria (*Bacillus cereus*, *Enterococcus faecalis*, *Staphylococcus aureus*, *Geobacillus stearothermophilus*), gram-negative bacteria (*Escherichia coli*, *Acinetobacter baumannii*, *Salmonella abony*) and yeasts (*Candida albicans*) were analyzed in vitro. The encapsulated extracts were used to prepare the functional concentrated yogurt. It was established that the addition of 0.30–0.45% microencapsulated plant extracts caused the inhibition of the post-fermentation process, the improvement of the textural parameters of the yogurt during storage, thus the shelf life of the yogurt increased by seven days, compared to the yogurt simple. Mutual information analysis was applied to establish the correlation between the concentration of the encapsulated extracts on the sensory, physical-chemical, and textural characteristics of the yogurt.

Keywords: summer savory; rosemary; extraction; encapsulation; functional foods; concentrated yogurt

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1. Introduction

Yogurt is considered one of the most popular fermented dairy products [1]. Consumers demand yogurt not only because of the bioavailability of essential nutrients resulting from yogurt's bacterial activity [2] but also for the wide product variations that are available in terms of texture and flavor. Concentrated yogurt is a fermented milk in which the protein content has been raised to a minimum of 5.6% [3]. This type of yogurt has gained increased consumer interest due to the improved taste and texture as well as the health benefits of milk proteins [4,5]. In addition, concentrated yogurt could be beneficial in calorie-restricted diets because energy intake from protein has a greater effect on satiety than fat or carbohydrate intake [6]. Consequently, concentrated yogurt could be enriched with various bioactive ingredients such as probiotics, phenolic compounds, carotenoids, polyunsaturated fatty acids, dietary fiber, vitamins, mineral salts, and others. [7,8]. Phenolic compounds have demonstrated antioxidant, antimicrobial, and anti-inflammatory activity and exhibit anti-cancer effects [9], including phenolic compounds from aromatic plants. Therefore, phenolic

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