

## The Use of Antioxidant and Antimicrobial Properties of Plant Extracts for Increased Safety and Sustainability of Dairy Products

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**Abstract :** One of the most important areas of product development and research in the dairy industry is the product enrichment with active ingredients as well as leading to increased product safety and sustainability. The most expanding field of the active ingredients is the various plants' CO<sub>2</sub> extracts with aromatic, antioxidant and antimicrobial properties. In this study, 15 plant extracts were evaluated based on their antioxidant, antimicrobial properties as well as sensory acceptance indicators for the development of new dairy products. In order to increase the total antioxidant capacity of the milk products, it was important to determine the content of phenolic compounds and antioxidant activity of CO<sub>2</sub> extract. The total phenolic content of fifteen different commercial CO<sub>2</sub> extracts was determined by the Folin-Ciocalteu reagent and expressed as milligrams of the Gallic acid equivalents (GAE) in gram of extract. The antioxidant activities were determined by 2,2'-azinobis-(3-ethylbenzthiazoline)-6-sulfonate (ABTS) methods. The study revealed that the antioxidant activities of investigated CO<sub>2</sub> extract vary from 4.478-62.035 µmole Trolox/g, while the total phenolic content was in the range of 2.021-38.906 mg GAE/g of extract. For the example, the estimated antioxidant activity of Chinese cinnamon (*Cinammonum aromaticum*) CO<sub>2</sub> extract was 62.023 ± 0.15 µmole Trolox/g and the total flavonoid content reached 17.962 ± 0.35 mg GAE/g. These two parameters suggest that cinnamon could be a promising supplement for the development of new cheese. The inhibitory effects of these essential oils were tested by using agar disc diffusion method against pathogenic bacteria, most commonly found in dairy products. The obtained results showed that essential oil of lemon myrtle (*Backhousia citriodora*) and cinnamon (*Cinnamomum cassia*) has antimicrobial activity against *E. coli*, *S. aureus*, *B. cereus*, *P. fluorescens*, *L. monocytogenes*, *Br. thermosphacta*, *P. aeruginosa* and *S. typhimurium* with the diameter of inhibition zones variation from 10 to 52 mm. The sensory taste acceptability of plant extracts in combination with a dairy product was evaluated by a group of sensory evaluation experts (31 individuals) by the criteria of overall taste acceptability in the scale of 0 (not acceptable) to 10 (very acceptable). Each of the tested samples included 200g grams of natural unsweetened greek yogurt without additives and 1 drop of single plant extract (essential oil). The highest average of overall taste acceptability was defined for the samples with essential oils of orange (*Citrus sinensis*) - average score 6.67, lemon myrtle (*Backhousia citriodora*) - 6.62, elderberry flower (*Sambucus nigra flos.*) - 6.61, lemon (*Citrus limon*) - 5.75 and cinnamon (*Cinnamomum cassia*) - 5.41, respectively. The results of this study indicate plant extracts of *Cinnamomum cassia* and *Backhousia citriodora* as a promising additive not only to increase the total antioxidant capacity of the milk products and as alternative antibacterial agent to combat pathogenic bacteria commonly found in dairy products but also as a desirable flavour for the taste pallet of the consumers with expressed need for safe, sustainable and innovative dairy products. Acknowledgment: This research was funded by the European Regional Development Fund according to the supported activity 'Research Projects Implemented by World-class Researcher Groups' under Measure No. 01.2.2-LMT-K-718.

**Keywords :** antioxidant properties, antimicrobial properties, cinnamon, CO<sub>2</sub> plant extracts, dairy products, essential oils, lemon myrtle

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