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in the field of science and engineering of food industry-food technology

Title:

Comparison of antimicrobial and antioxidant properties of eucalyptus (Eucalyptus camaldulensis L.), cumin (L. Cuminum cyminum) and zenian (Trachyspermum ammi L.) essential oils with nisin

Instructor:

Dr. Mohammad Ali Najafi

Consultant Professors:

Dr. Mohammad Amin Miri

Dr. Sara Najafi Qaghelestani

By:

Mahsa Movasseghi

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Abstract

Maintaining food quality along with increasing shelf life is done by reducing, eliminating or controlling pathogenic microbial agents or spoilage agents in the food industry. Due to the fact that many harmful effects of chemical preservatives have been proven, and there are many concerns in this regard, the discussion of replacing them with a variety of natural compounds, including plant essential oils, which are natural and low-risk antibiotics, has increased. Therefore, it is necessary to conduct these studies first in laboratory models and then in food models in this case. In this research, the essential oils of three native plant samples of Sistan region, including eucalyptus, cumin, and zinnia, were extracted by water distillation method and the chemical constituents of essential oils were identified using gas chromatography equipped with a mass spectrometer (GC-MS). Next, the antibacterial effects of essential oils were investigated by the diffusion method in agar. Also, the lowest growth inhibitory concentration (MIC) and the lowest lethal concentration (MBC) of each of the antimicrobial agents against strains of *Staphylococcus aureus* PTCC 1337, *Listeria monocytogenes* ATTC 19118, *Bacillus cereus* PTCC 1857, *Escherichia coli* PTCC 1763, *Pseudomonas aeroginosa* PTCC 1074 and *Salmonella typhimurium* ATCC 14028 was investigated. The results showed that the most important compounds in eucalyptus essential oil are: ρ-Cymene (26.97%), Terpen-4-ol (9.38%), γ-Terpinene (6.09%), 1,8-Cineole (5.86%) and α-Phellandrene (15. 2 percent); Essential oil of women: thymol (45.65 percent), paracimen (27.13 percent), gammatrypinen (19.45 percent), betamyrcene (1.23 percent), beta pinene (0.92 percent) and cumin in cumin essential oil. Aldehyde (39.67 percent), γ-terpinene (17.35 percent), p-cymene (15.96 percent), β-pinene (6.86 percent). All antimicrobial agents showed an inhibitory effect against the target strains. The inhibitory effect of essential oils was influenced by the type of essential oil and bacterial strain. The results of the antimicrobial test using the agar diffusion method showed that the most effective compounds inhibiting the growth of *Listeria monocytogenes*, *Staphylococcus aureus*, and Pseudomonas aeruginosa were zenian, and for Salmonella typhimurium and Escherichia coli, eucalyptus essential oil and for Bacillus cereus were cumin. Also, the results of evaluating the antioxidant activity showed that the antioxidant activity of eucalyptus was the highest (55.73%). Xinan extract with 51.25% antioxidant activity and cumin with 28.06% antioxidant activity were ranked second and third, respectively. According to the results of this research, it is possible that eucalyptus, zenian, and cumin essential oils can control the growth of spoilage bacteria in the food and pharmaceutical industries. This important thing requires detailed clinical, economic and also in the real food environment.

Key words: volatile oil, antibacterial, natural preservative, nisin