

Title : Development and characterization of basil oil-encapsulated nanocarriers as antibacterial and antioxidant agents

Author(s) : Ampha Khampeearya

Student ID : 640510197

Major : Biochemistry and Biochemical Innovation

Advisor(s) : Dr. Pattanapong Thangsunan

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ABSTRACT

Basil oil is widely used in food and medical industries due to its antibacterial and antioxidant properties. However, the use of pure basil oil is limited by its low stability and high volatility. The development of nanoencapsulation systems is to enhance its stability and control the release of active ingredients. This study aimed to develop and characterize basil oil-encapsulated nanocarriers and study their abilities to inhibit bacterial growth and scavenge free radicals. Four nanocarrier formulations containing 0%, 0.5%, 1%, and 2% of basil essential oil were prepared. The stability of the prepared nanoparticles was then tested and the developed nanocarriers were stable for 2 weeks. The nanocarrier containing 2% basil oil was then selected as the finest condition. Using dynamic light scattering (DLS) analysis, the 2% basil essential oil formulation exhibited a particle size of 128.8 ± 2.75 nm, a polydispersity index (PI) of 0.213 ± 0.049 , and a zeta potential of -83.2 ± 5.80 mV. The antibacterial assays, including disc diffusion and agar dilution methods, demonstrated that the developed nanocarriers were not able to inhibit the growth of *Escherichia coli* and *Staphylococcus aureus* when compared with pure basil oil and gentamicin. The antioxidant properties of the nanocarriers were studied using DPPH and ABTS assays. The 2% basil essential oil formulation did not show antioxidant activity, while 100% pure basil oil had antioxidant activity. The half maximum inhibitory concentration (IC₅₀) values obtained from the DPPH and ABTS assays were 11.16% and 1.26%, respectively. However, further studies on the optimal concentration of basil oil encapsulated in the nanocarriers are needed to enhance the efficacy when used as antibacterial and antioxidant agents. The findings of this research are anticipated to become an initial platform for the development of efficient nanocarrier systems for encapsulating and releasing active compounds, with applications in cosmetics, food, and medical industries, thereby enhancing the value and efficacy of natural product-based formulations.

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