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Liposomal Nanoencapsulation of Royal Jelly with gold-TiO_2

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ABSTRACT

Royal jelly is an apicultural product recognized for its nutritional and pharmacological properties, which have been utilized for centuries due to its anti-inflammatory effects, immune system enhancements, antioxidant properties, and ability to increase energy levels[1]. However, the stability of royal jelly is often limited, and nanoencapsulation emerges as a tool to improve the bioavailability and stability of these bioactive compounds, as well as to enhance their effects[2]. This study aimed to develop a liposomal nanoencapsulation system for royal jelly, incorporating TiO2 nanoparticles with gold, and to evaluate its efficacy in improving the stability and properties of bioactives.Royal jelly was encapsulated in liposomes using an adapted Bangham method, in which lipids extracted from lecithin were dissolved in a mixture of chloroform and methanol. Royal jelly and TiO2Au nanoparticles were then added to the solution. After complete evaporation of the solvent, a dry lipid film was observed at the bottom of the flask. This film was subsequently hydrated with saline solution and subjected to agitation, allowing dispersion and formation of the liposomes encapsulating the bioactives.In this study, physical-chemical characterization methodologies were performed, including thermal analysis (TGA) and Fourier-transform infrared spectroscopy (FTIR). TGA results indicated that the incorporation of TiO2Au nanoparticles reduced the initial mass loss and increased stability through interactions with the liposomal structure. It was observed that the composition with only the addition of royal jelly exhibited a degradation curve similar to that of pure liposome, indicating that royal jelly had a less impactful role on the stability of the liposome but contributed to the structural organization of the liposomes due to its bioactive components.In the sample with the presence of liposome and gold-doped TiO2, a lower mass loss was observed in the initial degradation range, making it evident that the nanoparticle reduced the volatilization of organic components. The sample with Liposome + Royal Jelly + TiO2Au showed greater thermal resistance against decomposition at elevated temperatures. The results indicate that the interaction of bioactive components and nanoparticles with the liposomal matrix can modify the thermal degradation profile, delaying the volatilization of organic components and providing resistance to decomposition at high temperatures.The analyses of molecular interactions in the liposomal formulations with or without the addition of TiO2 and royal jelly were provided through Fourier-transform infrared spectroscopy (FTIR). Four groups were investigated: pure liposome, liposome with royal jelly, liposome with TiO2Au, and liposome with royal jelly and TiO2Au. Characteristic bands in the range of 3500-3200 cm-1 corresponded to O-H and N-H groups, indicating the presence of hydroxyls and amines derived from royal jelly and the liposomal structure. Additional bands indicated the presence of phosphate linkages, P=O and P-O-P, evidencing the structure of the lipids in the liposome. Formulations with the addition of TiO2Au exhibited characteristic bands of the Ti-O bond from TiO2.The samples demonstrated results indicating that nanoencapsulation with liposomes containing royal jelly and TiO2Au is an effective approach to stabilize bioactive compounds, improving thermal resistance and expanding therapeutic potential for future biotechnological applications.

1. Guo J, Wang Z, Chen Y, Cao J, Tian W, Ma B, et al. Active components and biological functions of royal jelly. Vol. 82, Journal of Functional Foods. Elsevier Ltd; 2021.
2. Pourmobini H, Kazemi Arababadi M, Salahshoor MR, Roshankhah S, Taghavi MM, Taghipour Z, et al. The effect of royal jelly and silver nanoparticles on liver and kidney inflammation

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