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The use of encapsulation technique in the formulation of bacteriophages

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Statement of Problem: The emergence of multi-drug resistant bacteria through random mutation and genetic transfer is an evolving phenomenon with wide-reaching consequences. Therefore, new strategies, including the potential use of lytic bacteriophages, have been considered for targeting bacterial infections.

Research Purpose: Recently, several phase I and II clinical trials of phage therapy have succeeded. With the progress of phage therapy toward phase III clinical trials, several strategies based on the encapsulation of bacteriophages to produce phage formulations have been considered.

Research Method: The research method involved searching the Science Direct, PubMed, and Google Scholar databases.

Results and Conclusion: The formulation of bacteriophages, encapsulated by spray and freeze-dried powders, emulsions and liposomes, leads to the use of phages in semi-solid, edible products, and improvements in phage stability during the formulation process. Based on the experiments, the lytic activity of bacteriophage k against *Staphylococcus aureus* in the form of nano-emulsion leads to the use of topical formulations to improve skin infections caused by *Staphylococcus aureus*. Also, the stability of bacteriophages PEV2 and PEV4 against *Pseudomonas* using the Spray-Drying technique showed a 1-log drop in titer after one year at 20 °C. Moreover, the formulation of bacteriophages using cationic hydrogels, liposomes, and alginate polysaccharide causes the penetration of phages into bacterial biofilms and the release of active phage particles to reach the site of infection in the long term and prevents inactivation by the acidic pH of the stomach. As a result, more research on the formulation of bacteriophages



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requires serious attention in terms of the ease of increasing production and alternatives to antibiotics.

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