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Interaction of surfactants of natural origin with phospholipid membrane

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The principal challenge to antibiotic efficacy stems from the restricted bioavailability dictated by cell membrane permeability. While antibiotics like amphotericin B and polymyxin B target membrane disruption, the escalating antibiotic resistance diminishes their effectiveness, leading to the necessity for escalated doses. Consequently, various strategies have been categorized into pharmaceutical, pharmacokinetic, and biological approaches. Central to these strategies is the enhancement of cell membrane permeability, achieved through methods such as synthetic inhibitors, silver nanoparticles, co-polypeptides, ultrasound-induced cavitation, physical membrane disruption, and biosurfactants. Thus, the research specifically delves into biosurfactants, focusing on saponins, which are plant-derived and renowned for diverse pharmaceutical properties.

Key research objectives encompass the acquisition of saponin-rich plant extracts, the construction of model biomembranes, and the assessment of saponins' influence on bacterial and fungal cells. Furthermore, the research endeavours to evaluate the synergy between saponins and antibiotics, particularly those with surfactant properties, both in vitro and in vivo. This study effectively addresses critical knowledge gaps concerning saponins' interactions with cell membranes, presenting valuable insights into potential improvements in drug bioavailability and efficacy.

The first goal involved obtaining saponin-rich plant extracts from *Saponaria officinalis, Glycyrrhiza glabra, and Sapindus mukorossi*. Gas chromatography, mass spectrometry, surface tension analysis, and liquid chromatography were employed for extract analysis. The second goal focused on creating model biomembranes using multilamellar liposomes made from specific phospholipids found in cell membranes. These biomembranes were treated with extracts, and properties were assessed through ATR-FTIR, dynamic light scattering, and electrophoretic light scattering. Next, the influence of extracts on bacterial and fungal cells, including *Pseudomonas* and *Candida* were determined. Cell properties were analyzed after exposure to saponins, assessing dye adsorption, permeability, metabolic activity, zeta potential, and size distribution. The final step involved assessing the synergy between saponins and antibiotics, particularly those with surfactant properties, both in vitro and in vivo. Results obtained so far proves the potential for saponin use not only as a drug adjuvant but also as an additional agent in liposomal Drug Delivery Systems.

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