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Formulation and Characterization of Thermostable Nanostructured Lipid Nanocarrier for mRNA vaccine Delivery

Amit Acharya, Samarpita Sarangi, Pradipta Ranjan Rauta*
School of Biological Sciences, AIPH University, EAST Campus, Prachi Vihar, Anantapur, Phulnakhara- 754001

Introduction

- mRNA-based vaccines become alternatives for the quick and cost-effective production to address a growing number of infectious disease including cancer immune therapies.
- The fragile molecule mRNA, should be protected against extracellular degradation for increasing the effectiveness of the vaccine.
- Lipid Nanoparticles (LNPs) are most clinically advanced non-viral vectors that used in targeted intracellular delivery of mRNA.

Objectives

- Synthesis of soya lecithin nanoliposomes encapsulated mRNA.
- Physico chemical characterization of formulated lecithin-mRNA nanoliposomes.

Methods

- Preparation of soya lecithin nanoliposomes encapsulated mRNA.
- Determination of Size, charge, zeta potential measurements of nanoliposome.
- Drug release study and determination of stability of nanoliposome at different pH and temperature.
- Encapsulation efficiency of RNA and serum stability of nanoliposome encapsulated mRNA .

Results and Discussion

Fig 1. Primary Screening of Liposome under light microscope.

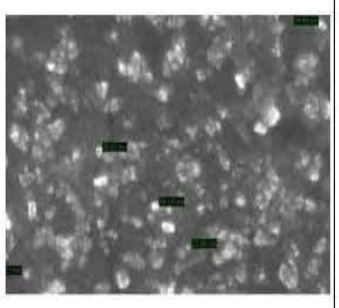
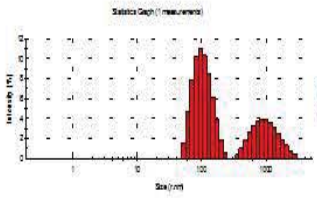
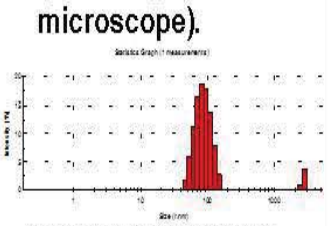


Fig.2. Morphology of the liposome was investigated by SEM (Scanning electron microscope).



(a) Control (without RNA) 185.15±136.96nm



(b) Sample (with RNA) 88.11±34.88nm

Fig.3. From the DLS (Dynamic light scattering) study, the hydrodynamic diameter of the synthesized liposome (a) without RNA and (b) with RNA was found to be 185.15±136.96nm and 88.11±34.88nm respectively.

Time (Hours)	Cumulative drug release(%)
0	7.9
1	14.7
3	22.7
6	36.1
12	47.5
24	59.7
48	68.3
72	76.7

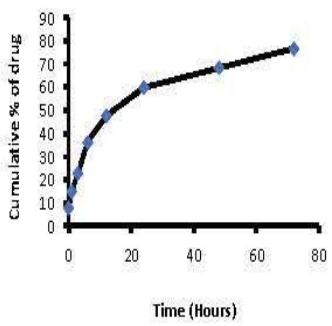
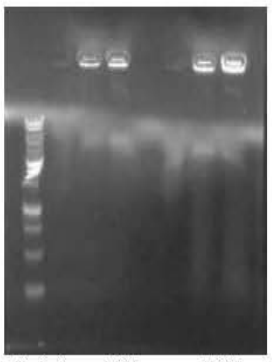
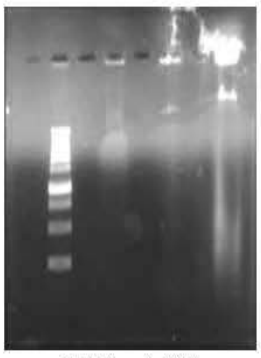


Fig.5. Invitro drug release study of synthesized lecithin nanoliposomes encapsulated mRNA.





6.(a). at 0hr and 6hr 6.(b). at 24hr

Fig.6.Serum stability of nanoliposome encapsulated RNA was monitored at different time interval (0hr, 6hr and 24hr).

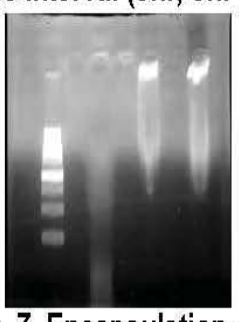


Fig. 7. Encapsulation efficiency of RNAs in soya lecithin nanoliposomes will be monitored by gel retardation assay of RNA.

Conclusion

The result shows the interaction between nanoliposome and mRNA that support the mRNA-vaccine technology.

- lipid Nanocarrier for mRNA vaccine delivery could significantly improve distribution of current and future pandemic response vaccines, in low- resource areas.

References

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