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Development of artificial therapeutic pulmonary surfactant to control oxidative stress in respiratory inflammation cases

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Background: Pulmonary surfactant (PS) plays a pivotal role in normal breathing process and prevention of alveolar collapse by dynamically modulating surface tension (from ~25 to near 0 mN/m surface tension) at air-liquid interface. PS composition is altered/destroyed due to high oxidative stress and fluid fatty acids produced in inflamed lungs thereby rendering PS dysfunctional. In the present study, surface active Dipalmitoyl phosphatidylcholine (DPPC) liposomal system with active therapeutic adjuvant D-α-Tocopheryl polyethylene glycol 1000 succinate (TPGS) has been formulated as a protective aerosol in oxidative stress.

Method: Tensiometric analysis of phospholipid-TPGS monolayer films was done in Langmuir-Blodgett trough. Liposomal formulations were prepared using thin film hydration method. Particle size and shape characterization of potential liposomal formulations was done using dynamic light scattering and electron microscopy. Lipid peroxidation of soybean lecithin in presence and absence TPGS was done by thiobarbituric acid assay (TBARS) method. *In-vitro* biocompatibility of developed liposomal formulation was evaluated in A549 cell line. Developed liposomal system was also evaluated for airway patency maintenance using capillary surfactometer.

Result: DPPC:TPGS 1:0.25 to 1:1 w/w Langmuir film attained near zero surface tension like natural PS. Adsorption isotherm studies showed additing incremental amount of TPGS to DPPC liposomes aid lowering surface tension reached in 1 second from 46.41 ± 0.57 mN/m to 40.41 ± 0.55 mN/m. Liposome particle size were in the range of 200-350 nm. Incremental addition of TPGS reduced lipid peroxidation of soybean lecithin liposomes lowering TBARS value by 29-52 %. DPPC:TPGS liposomal formulation were found to be biocompatible and maintained capillary (airway) > 95 % patent.

Conclusion: An artificial PS with improved surface activity and antioxidant capability has been developed. The liposomal system is biocompatible and maintains capillary (airway) patency making it a promising adjuvant for therapy in respiratory inflammation.

Biography

Apurva R. Shah is presently a Ph.D student guided by Prof. Rinti Banerjee at Indian Institute of Technology Bombay, India. His research area involves design and development of drug and polymer added lipid based novel drug delivery system for respiratory ailments. He has couple of publications under his name related to his research area.