Glycosylated Hybrid Lipid Polymer Nanoparticles for Controlled Inhalable Co-Delivery of Docetaxel and Nintedanib in Non-small cell lung cancer

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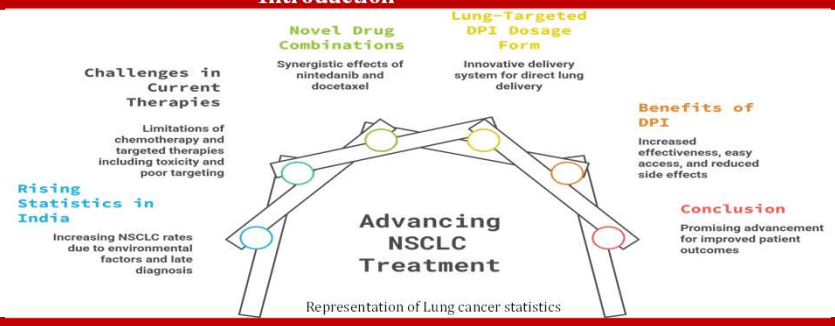
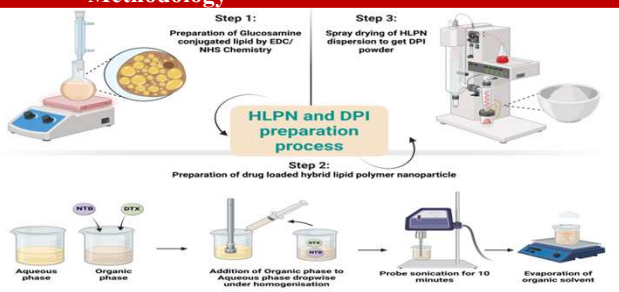
Introduction



Representation of Lung cancer statistics

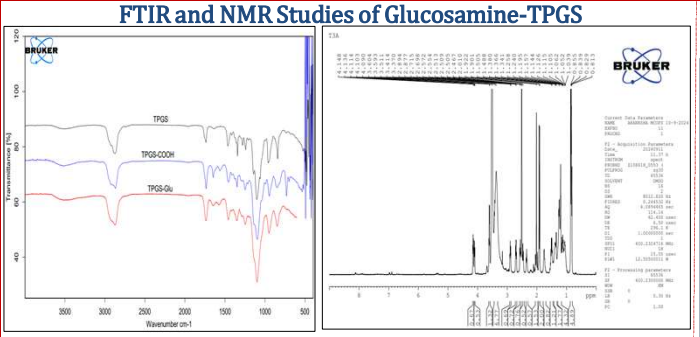
Methodology



Steps involved in formulation development

Results and Discussion

FTIR and NMR Studies of Glucosamine-TPGS

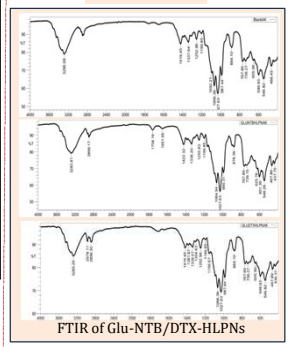


FTIR: TPGS-Glu C=O intensity increased due to TPGS-COOH giving 1736.66 cm^{-1} and NH stretching group of glucosamine-TPGS giving 3473.80 cm^{-1}

^{1}HNMR: NH protons had chemical shift value of 3.370 and for CH_2 protons of 2.467 to 2.698

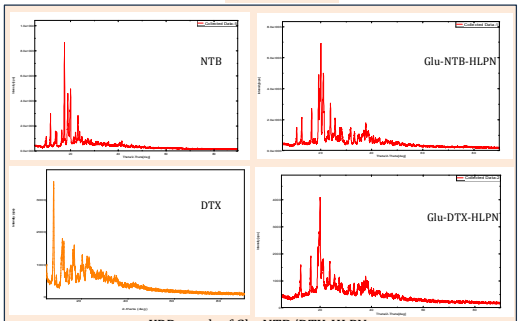
Characterization of optimized Glu-HLPN

FTIR Studies



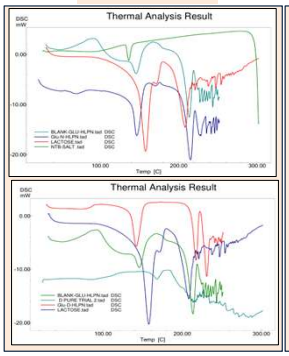
FTIR of Glu-NTB/DTX-HLPNs

XRD Studies



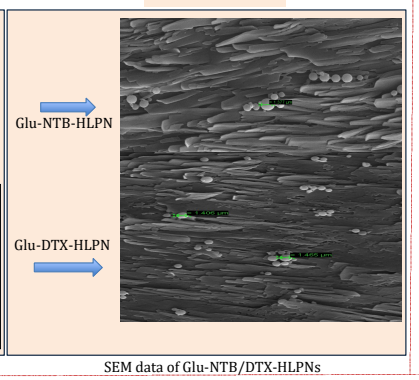
XRD graph of Glu-NTB/DTX-HLPNs

DSC Studies



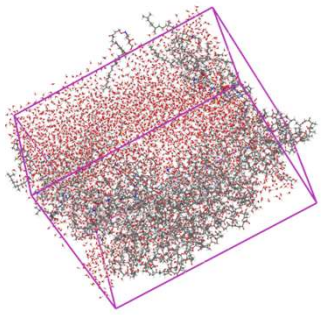
DSC overlay of Glu-NTB/DTX-HLPNs

SEM Studies

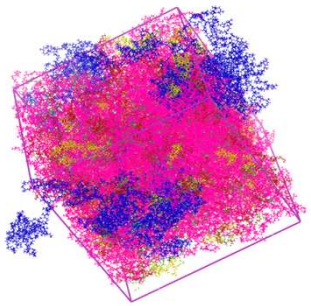


SEM data of Glu-NTB/DTX-HLPNs

Mechanistic studies of formulation through computational modeling

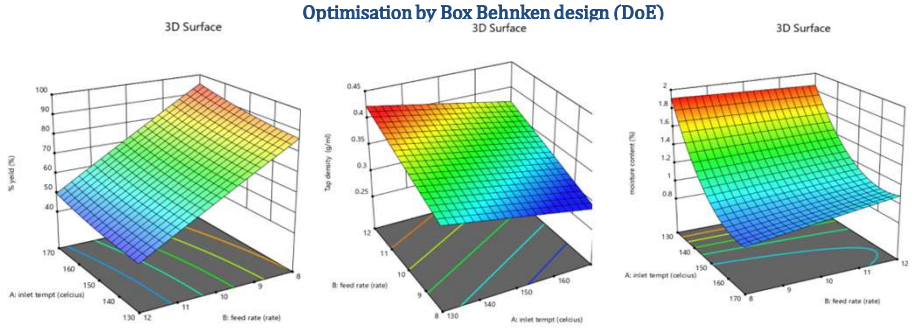


Glu-NTB-HLPN system after 100 ns



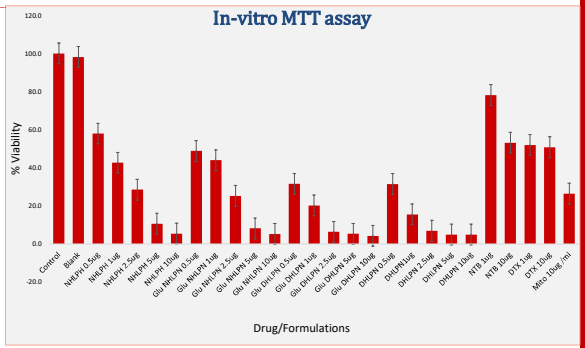
Glu-DTX-HLPN system after 100 ns

Optimisation by Box Behnken design (DoE)



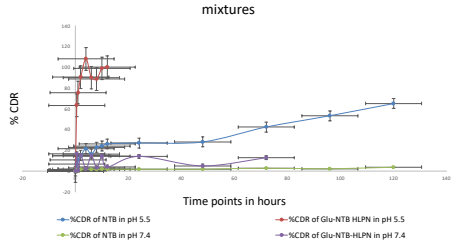
Effect of Inlet temp, Feed rate and Aspiration rate on Percent yield, Moisture & Tapped density

In-vitro MTT assay

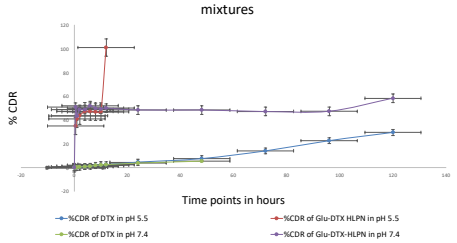


Release study of standard drug and formulations in pH 5.5 & 7.4

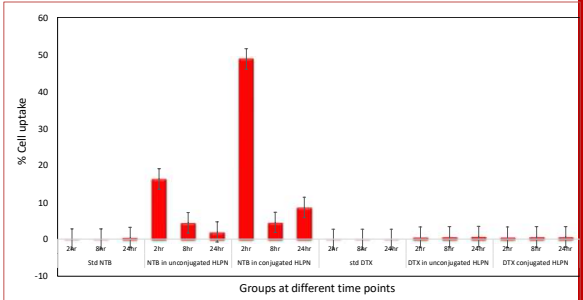
% CDR of NTB, GLU-NTB-HLPN at pH 5.5 and pH 7.4 in mixtures



% CDR of DTX, GLU-DTX-HLPN at pH 5.5 and pH 7.4 in mixtures



In-vitro cell uptake studies



Conclusion

TPGS-Glucosamine synthesized and confirmed by FTIR and ^{1}H NMR. NTB & DTX successfully loaded into Glu-HLPNs via solvent evaporation; particles were spherical, nano-sized, and stable (zetasizer, SEM), Molecular stability confirmed by computational studies (Schrödinger)

In vitro release superior at pH 5.5 for both Glu-NTB and Glu-DTX HLPNs MTT assay: improved % viability and greater cell uptake for glyco-conjugated formulations

Box–Behnken DoE optimized spray drying: inlet temperature, feed rate, and aspiration rate as independent factors; % yield, tapped density, and moisture content as responses

Glu-NTB/DTX HLPNs demonstrated stable drug loading, pH-responsive release, enhanced cellular uptake, and scalable, optimized DPI production

References

[1] Delpierre C et al Precision and personalized medicine: What their current definition says and silences about the model of health they promote. Implication for the development of personalized health. Frontiers in Sociology 2023;8.

[2] Ashique S et al. Nano-mediated strategy for targeting and treatment of non-small cell lung cancer (NSCLC). Naunyn-Schmiedeberg's Arch Pharmacol 2023;396:2769–92.

[3] Ren J et al. Precision Nanomedicine Development Based on Specific Opsonization of Human Cancer Patient-Personalized Protein Coronas. Nano Lett 2019;19:4692–701.

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