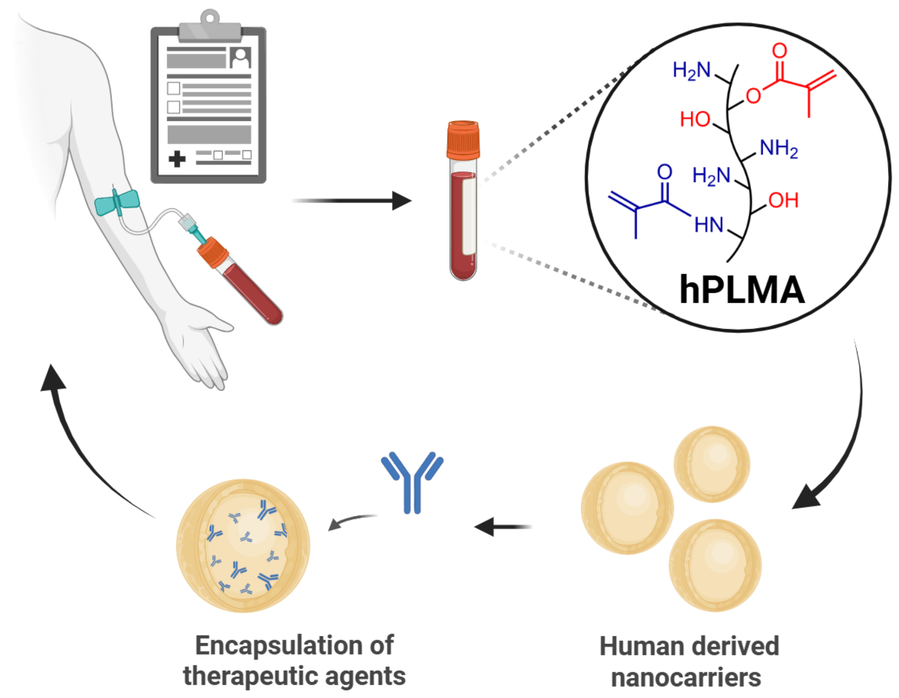
Human Platelet Lysate-Derived Nanoparticles for Antibody Delivery

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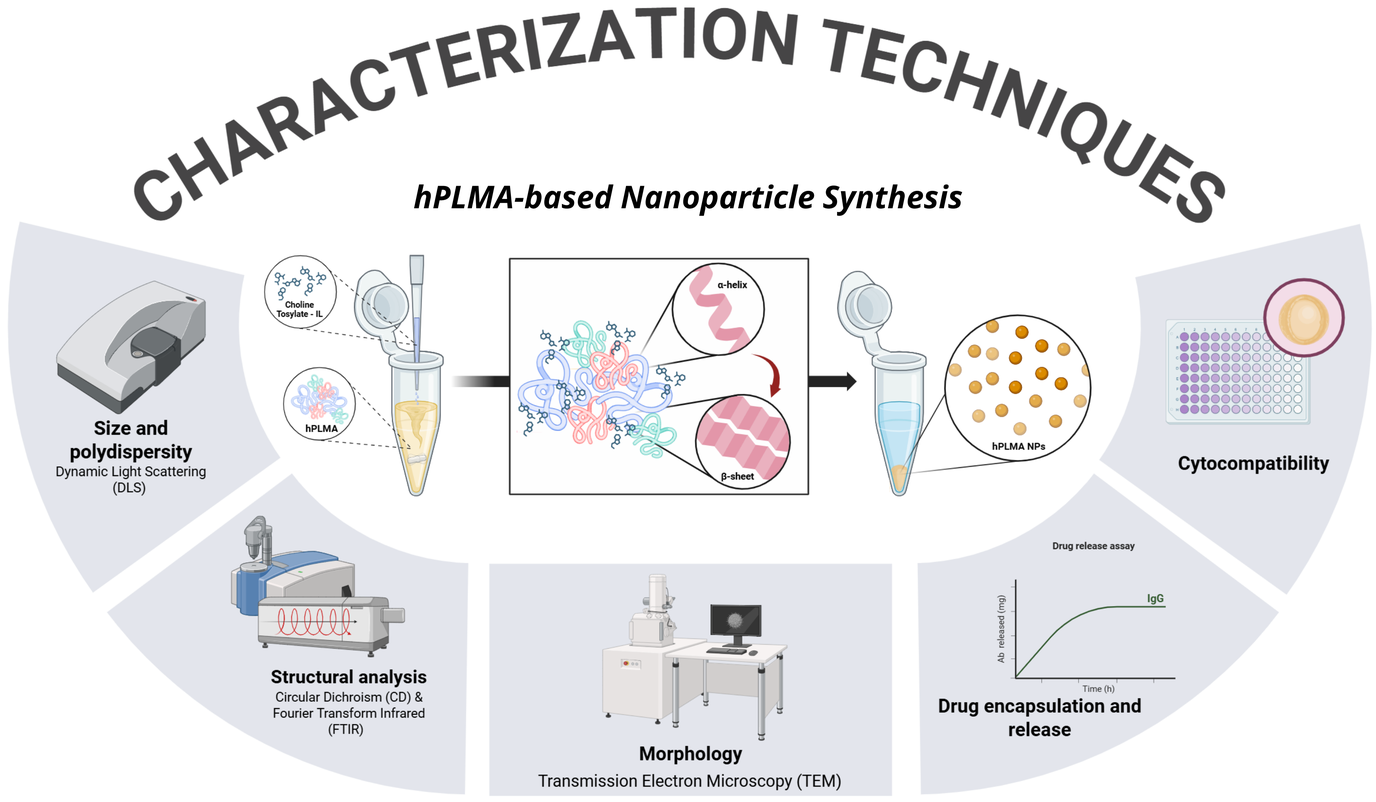
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Introduction



Human methacryloyl platelet lysate (hPLMA) is a protein-rich material derived from human blood, which has emerged as a promising biomaterial for various biomedical applications. In particular, hPLMA-based nanoparticles have significant potential for controlled drug delivery, offering a platform for the sustained release of therapeutic agents.

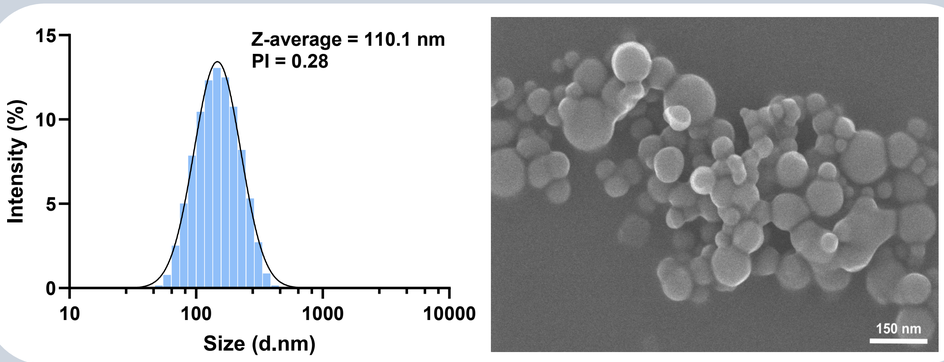
Methodology



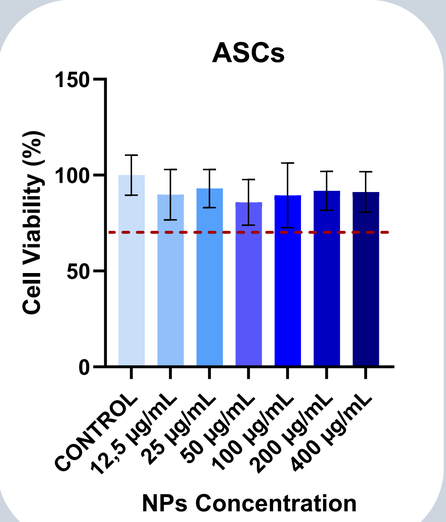
hPLMA nanoparticles were generated via ionic liquid-induced assembly, where the addition of Choline Tosylate to an aqueous protein solution under agitation triggered protein conformational rearrangement (α-helix to β-sheet) and nanoscale particle formation.

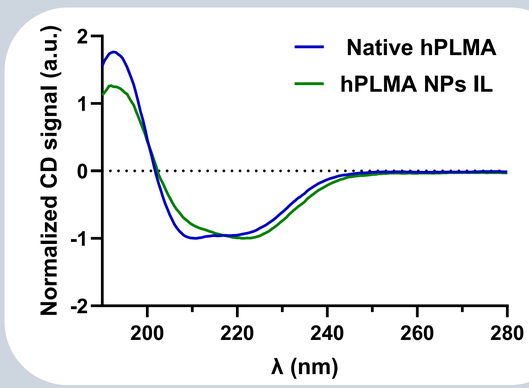
Results

- Process parameters were optimized through a multivariate Design of Experiments approach, yielding particles with a Z-average diameter of ~110 nm and a narrow, unimodal size distribution under optimized conditions.
- Transmission electron microscopy confirmed the formation of well-defined spherical hPLMA nanoparticles.

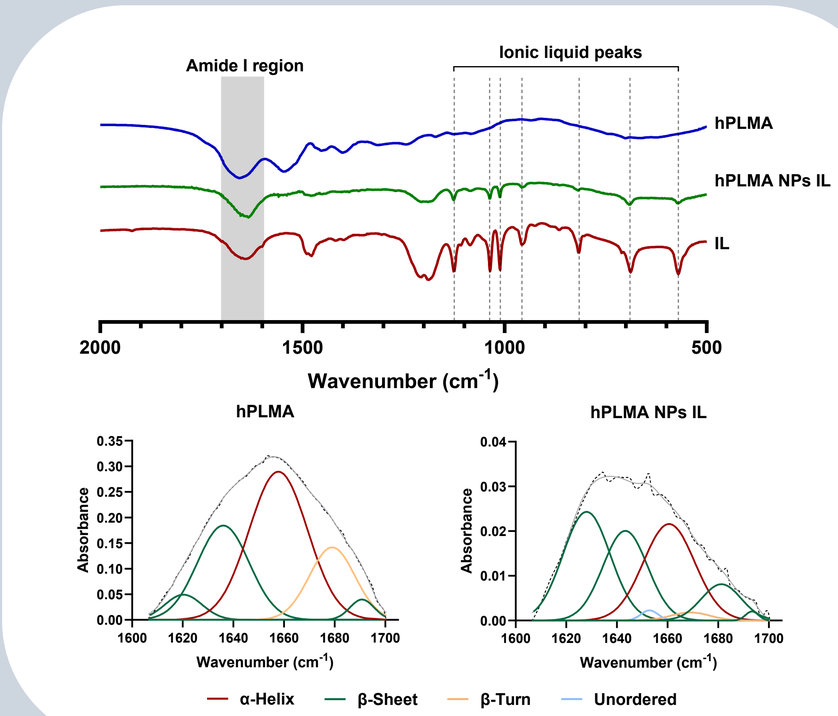


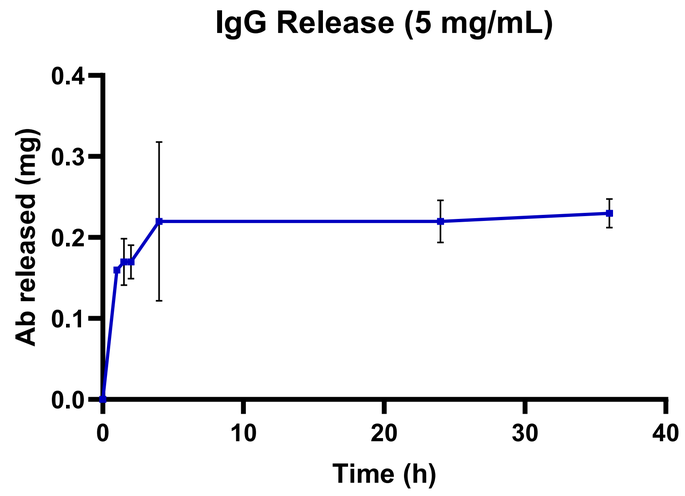
- Human IgG was efficiently encapsulated within hPLMA nanoparticles and exhibited a biphasic release profile over 36 h at physiological temperature, characterized by an initial burst phase followed by sustained release.
- Unloaded hPLMA nanoparticles preserved cellular metabolic activity in ASCs after 72 h exposure, with viability comparable to controls, indicating good cytocompatibility and absence of cytotoxic effects.





- Combined CD and FTIR analyses revealed pronounced secondary-structure rearrangement upon ionic liquid interaction:
  - CD spectra showed attenuation of characteristic α-helical bands, indicating loss of native helical organization.
  - FTIR analysis of the Amide I region, supported by peak deconvolution, confirmed redistribution toward β-sheet–associated and less ordered structures, evidencing conformational reorganization of hPLMA proteins underlying nanoparticle assembly, with characteristic ionic liquid bands detected in the synthesized nanoparticles.





Conclusions

- **Ionic liquid-induced assembly** enabled the reproducible formation of **hPLMA nanoparticles**, with synthesis parameters refined through **Design of Experiments (DoE)**. Spectroscopic analyses confirmed protein **conformational rearrangement (α-helix to β-sheet)** underlying nanoparticle assembly, together with the presence of **characteristic ionic liquid signatures**.
- The nanocarriers achieved **efficient human IgG encapsulation** and exhibited a **biphasic release profile** over 36 h, while preserving cellular metabolic activity in ASCs, demonstrating their **cytocompatibility**.
- Together, these findings establish hPLMA nanoparticles as a **versatile and effective platform for protein delivery**.

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