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Single Crystal Matrix Isolation of Biopharmaceuticals for Enhanced Stability

A novel peptide nano-crystal system stabilizes protein-based drugs and commercially valuable proteins, eliminating the need for cold storage and improving product shelf life.

Researchers at Purdue University have developed a platform technology comprising a nano-delivery system that stabilizes protein cargoes to prevent aggregation during storage at room or elevated temperature with retention of protein bioactivity. Current formulations of protein biopharmaceuticals in solution require specialized low-temperature equipment and careful handling to avoid stability changes and subsequent degradation that renders them inactive. Purdue researchers designed a trimeric coiled coil peptide nano-crystal that can stably incorporate His-tagged protein cargoes, limiting protein deterioration while preserving tertiary structure and stability of the protein cargo. The researchers incorporated green fluorescent protein (GFP) and red fluorescent protein (RFP) at one to two percent of the total crystal volume. This technology will facilitate room temperature storage of protein drugs and other proteins of commercial interest, allowing availability in locations that do not have cold storage facilities.

Technology Validation: Trimeric coiled coil peptide crystals containing His8-tagged GFP were subjected to elevated temperatures and compared to protein solutions of His8-GFP without the coiled coil peptide nano crystal. Crystals containing His8-GFP displayed fluorescence even after being heated to 100 degrees Celsius for 1 hour, whereas solutions of His8-GFP alone were no longer fluorescent after 1 minute, indicating that the 3D crystal assembly is required to maintain functionality and protein stability at elevated temperatures.

Advantages

-Improves stability of proteins including protein-based drugs

-No need for cold storage

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Category
Biotechnology & Life Sciences/Bioprocessing & Biomanufacturing
Chemicals & Advanced Materials/Specialty & Performance Chemicals
Pharmaceuticals/Drug Discovery & Development
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies
Pharmaceuticals/Drug Delivery & Formulations

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Applications

-Improves shelf life of biopharmaceuticals

-Isolation of proteins in a crystal matrix

Publications:

Jorgensen, M. D.; Chmielewski, J. "Co-assembled Coiled-Coil Peptide Nanotubes with Enhanced Stability and Metal-Dependent Cargo Loading" ACS Omega. 2022, 7, 24, 20945â€“20951.

Curtis, R. W.; Scrudders, K. L.; Ulcickas, J. R. W.; Simpson, G. J.; Low-Nam, S. T.; Chmielewski, J. "Supramolecular Assembly of His-Tagged Fluorescent Protein Guests within Coiled-Coil Peptide Crystal Hosts: Three-Dimensional Ordering and Protein Thermal Stability" ACS Biomater. Sci. Eng. 2022, 8, 5, 1860â€“1866.

TRL: 3

Intellectual Property:

Provisional-Gov. Funding, 2021-01-13, United States | NATL-Patent, 2022-01-13, Europe | PCT-Gov. Funding, 2022-01-13, WO | NATL-Patent, 2023-07-12, United States

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