Case study: Lyophilised Exosomes for Injection Formulation Development and Cycle Optimisation

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ABSTRACT

Recently, a collaborative effort commenced between Biopharma Group, a leading Contract Development and Manufacturing Organisation (CDMO) specialising in lyophilisation, and a prominent US-based client. The objective of this partnership was to enhance an existing lyophilised product containing exosomes for drug delivery in gene therapy. The primary aims of this project were to preserve the exosome structure during the lyophilisation process, reduce cycle times, and improve the acceptance rates of lyophilised batches.

The decision to undertake this project was informed by a thorough assessment of its potential commercial and operational benefits. Notably, the return on investment became evident, considering the elimination of the cold chain requirement (storage at -20°C), optimisation of storage and transportation, streamlining of operations, and the overall enhancement of product quality.

This poster provides both a commercial and scientific overview of this cutting-edge Research and Development (R&D) project.

SCHEDULE?

- **EXPECTED:** Initially estimated 10-16 weeks
- **ACTUAL:** Work concluded in 14 weeks

WHO FOR?

Client in US for US and EU market

WHAT?

- **Application:** exosomes for injection for drug delivery – Gene Therapy
- **Format:** 2ml vials, 1 ml fill volume
- **Batch size:** 3000 vials
- **Estimated commercial cost per vial:** $500

Requirements:

- Improvement of the existing formulation
- Retention of exosome structure after lyophilisation
- Reduction of existing cycle length from 96 hours
- Improvement of batch acceptance rate (reject rate was 3.2%)

HOW?

The Plan

Product Assessment

- Freeze Drying Microscopy
- Electrical Impedance analysis (Lyotherm)
- Modulated Differential Scanning Calorimetry
- Desktop study and data review

Formulation Development

- Liquid compatibility check
- Design of formulation by statistical DoE
- 2x Lyo cycles for formulation screening

Lyo Cycle Optimisation

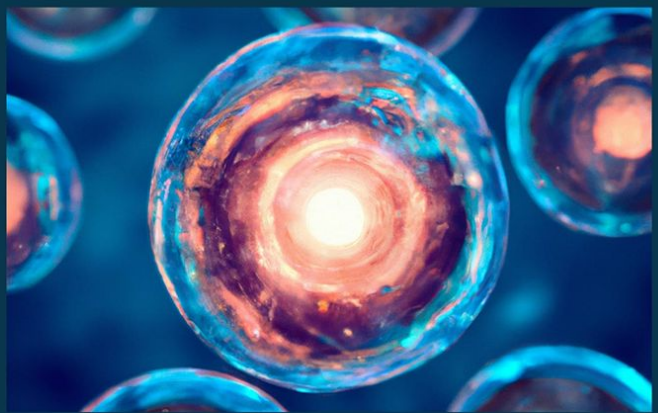
- 4x Lyo cycles for recipe optimisation
- List of candidate formulations refined further
- Final Lyo cycle tailored to best candidate

Analyses

- Particle size distribution
- Reconstitution
- Residual moisture content
- Dry state stability

WHY? The Benefits

- Elimination of the cold chain (product stored at -20 °C, even when lyophilised)
- Efficient storage and transportation
- Optimised operations
- Reduction of batch rejection rate



CONCLUSIONS & RETURN ON INVESTMENT

- The cycle run time was reduced by 24%, leading to a 31% increase in productivity
- Batch rejection rate improved from 3.2% to 0.6%, providing a saving of c. $40,000 per batch). Expected 4 batches a year for a total saving of $160,000.
- The developed product was stable at room temperature, removing the need for -20 °C shipments (estimated saving of $15,000 per year) and freezers in the 4 sites in EU and US.
- R&D investment recovered within just 1x batch (saving from improved rejection, shipments and productivity)

+$160,000
SAVING/YEAR
ON MANUFACTURING

+31%
PRODUCTIVITY

+$15,000
SAVING/YEAR
ON COLD CHAIN ELIMINATION