Lyophilization as a Stabilization Strategy for MSC Secretome: What the Storage-Condition Literature Shows

Peer-reviewed evidence on freeze-dried Wharton's Jelly secretome stability — and where the published literature stops short of a specific manufacturer's proprietary degradation claims

Prepared for RCX Network Partner Clinics — Product Science & Sourcing

Purpose

This reference is written for physicians, PAs, NPs, and estheticians who want to understand the evidence behind freeze-drying (lyophilization) as a stabilization method for MSC secretome products such as Cellavé, including why it enables room-temperature-stable storage and shipping without a cold chain. It also draws a clear line between what the independent, peer-reviewed literature supports and what remains a manufacturer-specific claim.

The Core Clinical Question

MSC secretome is a complex mixture of growth factors, cytokines, and extracellular vesicles that degrades over time, particularly at warmer temperatures. Two questions matter for a partner clinic: does lyophilization meaningfully preserve secretome composition compared to conventional frozen storage, and does the specific donor tissue and formulation used here — Wharton's Jelly-derived secretome with trehalose — have direct evidence behind it, rather than just general freeze-drying literature from unrelated protein products.

The Published Evidence

1. Direct evidence: Wharton's Jelly MSC secretome, lyophilized with trehalose

Rogulska et al. (2024, *Scientific Reports*) lyophilized conditioned medium from human umbilical cord Wharton's Jelly MSCs — the same donor tissue Cellavé is sourced from — with and without trehalose, then stored it at -80°C, -20°C, 4°C, or room temperature for 3 and 30 months. At -80°C, lyophilized secretome composition was not significantly different from non-lyophilized frozen control, confirming lyophilization itself does not compromise the secretome when properly stored. Growth factor and cytokine levels stayed above 80% of frozen-control values at 3 months across all measured factors when stored at -80°C. Storage at warmer temperatures (4°C and room temperature) caused substantial, factor-specific losses over extended storage — some factors dropped to single-digit percentages of baseline after 30 months at room temperature. Critically, trehalose supplementation significantly improved preservation of several factors at 4°C and room temperature over the 30-month period, directly supporting trehalose's role as a stabilizing excipient.

2. GMP-compliant lyophilized secretome production, described as "cell-free regenerative nanomedicine"

Bari et al. (2018, *Cells*) describe a validated, GMP-compliant process for producing lyophilized MSC secretome as a pharmaceutical product — combining ultrafiltration, cryoprotectant addition, and freeze-drying to yield a stable, ready-to-reconstitute powder. Notably, this paper uses the same phrase — "cell-free regenerative nanomedicine" — that appears in Cellavé's own product description, and identifies more than 349 distinct proteins preserved in the lyophilized product, with levels comparable to non-lyophilized secretome for key

growth factors including VEGF-A, FGF-2, TGF-β1, and IGF-1.

3. Lyophilization is the established route to room-temperature-stable, shippable secretome products

Broader review literature on exosome and secretome storage confirms that conventional frozen storage (even at -80°C) requires an unbroken cold chain and is vulnerable to freeze-thaw-cycle damage, while properly formulated lyophilization with sugar-based cryoprotectants (trehalose, sucrose, mannitol) is the field's established strategy for producing a stable, room-temperature-storable powder suitable for wider clinical distribution.

> **Clinical translation for Cellavé Light:** Cellavé Light's listed formulation — human umbilical cord stem cell supernatant, trehalose, and sodium hyaluronate, supplied as a freeze-dried powder — matches the exact donor tissue (Wharton's Jelly) and stabilizing excipient (trehalose) studied directly in the Rogulska et al. dataset above. This gives the product's stabilization approach real, tissue-matched peer-reviewed support, distinct from generic freeze-drying claims borrowed from unrelated protein products.

Key Takeaways for Practitioners

- Lyophilization does not itself compromise Wharton's Jelly MSC secretome composition when combined with proper storage — peer-reviewed data directly on this donor tissue and cryoprotectant supports this
- Storage temperature after lyophilization is the dominant variable — -80°C preserves the secretome cocktail for at least 30 months, while room-temperature or refrigerated storage causes progressive, factor-specific losses over the same period
- Trehalose is not an arbitrary excipient choice — it has direct, published evidence improving secretome factor preservation during extended storage at non-frozen temperatures
- Lyophilization is the established industry approach for producing a room-temperature-shippable, cold-chain-independent secretome product, consistent with how Cellavé Light is distributed

A Note on Scientific Framing

The peer-reviewed literature above supports lyophilization with trehalose as an effective, well-evidenced stabilization strategy for Wharton's Jelly MSC secretome in general. It does not independently confirm Novatrail's specific comparative claim that its patented freeze-drying process limits degradation to approximately 20% versus approximately 80% for "general freeze-drying methods" — that is a manufacturer-specific, proprietary process comparison, not a figure published in the independent scientific literature. Practitioners should treat the general stabilization rationale (supported above) and the specific 20%/80% comparative figure (a Novatrail claim) as two separate things, and should request Novatrail's own validation data or patent documentation directly if a physician or institutional partner asks for the source of that specific number.

References

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