

Interview

by Cindy H. Dubin

STEVANATO GROUP

Riccardo Prete,
Product Manager for the Vial
Platform



STUDY CONCLUDES THE USABILITY OF NESTED VIALS FOR LYOPHILIZATION

The complex structures of biologics demand packaging that minimizes mechanical stress and ensures consistent process conditions. Furthermore, maintaining biological activity—such as enzyme function—is critical. Stevanato Group offers a range of advanced primary packaging solutions designed to meet the stringent requirements of biologics and lyophilized drug products. Through an extensive series of tests in collaboration with the Politecnico di Torino, Stevanato Group demonstrated that its EZ-fill® nested vials are a lyophilization solution suited to improving bioactivity preservation and process efficiency. Riccardo Prete, product manager for the Vial Platform, Stevanato Group, explains that the overall results of the study confirm the usability of nested vials for lyophilization and, most importantly, demonstrate their potential as a high-quality solution for freeze-dried drug products.

Describe Stevanato Group's package offerings and explain how they address freeze-drying challenges.

RICCARDO PRETE: Stevanato Group's EZ-fill® nested vials offer a proven and reliable solution. These ready-to-use vials are supplied in a standardized nest-and-tub format that complies with ISO 21882 and support flexible, sterile, small-batch manufacturing. To evaluate their suitability for lyophilization without additional handling steps, Stevanato Group collaborated with Politecnico di Torino on a two-part scientific study. The results confirmed that nested vials can be freeze-dried effectively while delivering key advantages:

- Reduced risk of breakage and contamination due to the elimination of glass-to-glass contact.
- More consistent heat transfer within batches, as demonstrated by the lower variability in heat transfer coefficients.
- Improved biological product preservation – for instance, lactate dehydrogenase (LDH) retained nearly 40% more activity in nested vials compared to bulk vials after freeze-

thawing and lyophilization. This combination of mechanical protection, process consistency, and product integrity makes EZ-fill nested vials a robust choice for pharmaceutical companies aiming to de-risk development and scale-up.

How does EZ-fill help pharma clients ensure safety, stability and potency during storage?

R.P.: Our packaging systems are engineered not only for functional robustness, but also to actively contribute to the preservation of drug quality throughout the product lifecycle. In the context of freeze-dried biologics, maintaining safety, stability, and potency is particularly challenging due to the sensitivity of active molecules. The study conducted with Politecnico di Torino highlighted how EZ-fill nested vials play a critical role in this regard. Key findings include:

- Higher nucleation temperatures in nested vials lead to larger ice crystals and more open pore structures, which result in faster sublimation during the primary drying phase and improved drying uniformity.
- Despite slightly slower cooling dynamics, the drying profiles remained

consistent, and the resulting freeze-dried cakes showed superior morphology with lower residual surface area.

- Biological activity of LDH was significantly better preserved in nested vials, due to reduced interfacial stress and better thermal behavior.

Moreover, the uniform heat transfer observed in the nested format reduces variability both within and between batches — a crucial advantage when targeting consistent product quality in commercial-scale manufacturing.

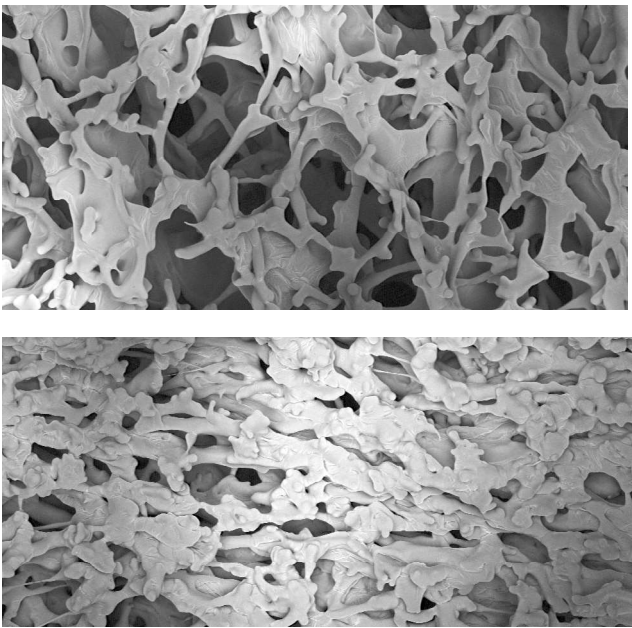
The significantly higher residual bioactivity, together with the virtually non-existent impact on freeze-drying cycle time and the above-mentioned advantages of EZ-fill containers, represent a high-value solution for lyophilized pharmaceutical products.

	Freeze-thawing (0.25°C/min)	Freeze-thawing (1.00°C/min)
Nest	36.9 (± 12.0) %	33.9 (± 12.4) %
Direct contact	17.1 (± 7.2) %	21.8 (± 6.8) %
	After lyophilization	
Nest	27.1%	
Direct contact	19.4%	

LDH residual activity obtained after the freeze-thawing and lyophilization for vials loaded in a nest and in direct contact with the shelf (Stevanato Group).

Did anything about the results of the study surprise you or stand out to you? Did the results confirm what you expected?

R.P.: One of the most relevant results that we did not focus on in previous studies is the key role of the nest design and material in guaranteeing an even heat transfer coefficient across the position of the vials. In moving from a position of the vials in contact with the shelf to a suspended position, we were expecting different behavior and a potential impact on timing; the fact that we observed little to no impact in the overall time cycle, which is critical for process scale-up, highlighted an additional benefit of the nested configuration that we were not openly expecting.



SEM images of the dried center of the cake – (up) nested vials and (down) in direct contact with the shelf (Stevanato Group).