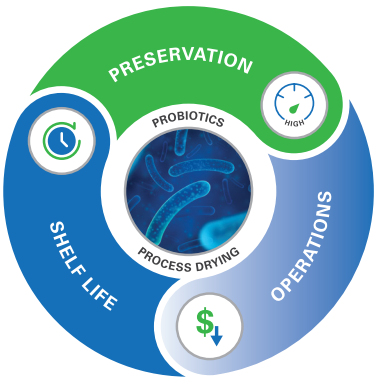
IMPROVING PROBIOTIC PROCESSING WITH ELECTROSTATIC SPRAY DRYING TECHNOLOGY

DATA SHEET

CHALLENGES WITH CONVENTIONAL DRYER PROCESSES

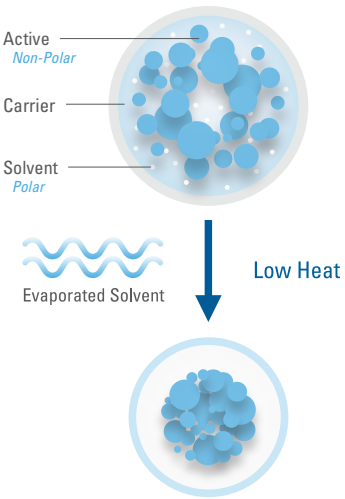
Probiotics, like the widely used *Lactobacillus plantarum*, are often dried to enhance stable shelf-life. Tests of *Lactobacillus plantarum* revealed that temperature and water activity were critical factors for probiotic survival during storage.

- Traditional spray drying causes inactivation of micro-organisms, due to the thermal and dehydration inactivation.
- Freeze drying can also damage biological systems, primarily because of the change in the physical state of membrane lipids or the change in the structure of sensitive proteins. Freeze drying is also time-consuming and energy intensive.



Common strategies employed to overcome these issues and optimize probiotic drying include:

- Inducing bacterial stress adaptation to enhance cellular intrinsic tolerance
- Applying protective agents to minimize cell damage during process
- Optimizing these conventional processes to moderate the harsh conditions



Why Electrostatic Spray Drying is Optimal for Probiotics

Fluid Air's PolarDry® technology employs electrostatic technology. The use of an electrostatic charge enhances the drying of sensitive products like probiotics.

- With a feedstock based on a polar solvent, the solid materials (probiotics and protective agent) are driven to the inside of the droplet, and the solvent (water) is driven to the outside, lowering the required evaporation temperature.
- The probiotics are protected by the formation of a thin layer of water on the surface of the particles during the drying This protects them from thermal stresses.
- PolarDry® uses nitrogen as drying gas, thus preventing oxidative stresses.
- The electrostatic charge on the bacteria increases the intracellular protective agent like trehalose content, to enhance bacterial strength.

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Proof of concept: *Lactobacillus plantarum* drying

We compared freeze drying to electrostatic spray drying, to evaluate the stability and viability of the probiotic *Lactobacillus plantarum*:

Figure 1:

Stability and viability of *L. plantarum* at room temperature

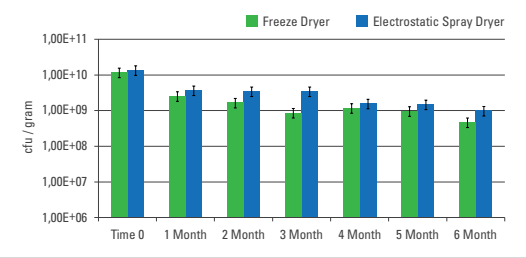
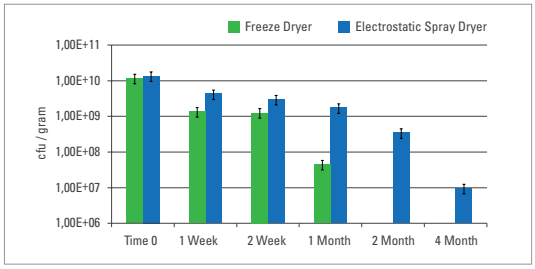


Figure 2:

Stability and viability of *L. plantarum* at 37°C



Room temperature results at 6 months:

- PolarDry® electrostatic spray dryer: -1 log
- Freeze Dryer: -1.2 log

37°C temperature results at 4 months:

- PolarDry® electrostatic spray dryer: -3 log
- Freeze Dryer: no live bacteria

Conclusion

The PolarDry® electrostatic spray dryer outperformed the freeze dryer method in optimal operating conditions. Moreover, the electrostatic spray dryer has approximately the same cost as a conventional spray dryer, and this continuous process costs five times less than freeze drying.

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