Technical Note
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Optimal Torque to Prevent Sample Loss During Cryostorage

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Figure 1. Thermo Scientific Matrix 2D Barcoded ScrewTop Tube

Key words

- Thermo Scientific Matrix 2D Barcoded ScrewTop Tubes
- Cryogenic Storage
- Cryopreservation
- Freeze-thaw Cycles
- VPLN (Vapor Phase Liquid Nitrogen)

Introduction

Cryopreservation is a common sample storage method for critical scientific research studies. Sample loss due to evaporation during long-term storage is a common problem that can prove troublesome or even disastrous. Sample loss can alter the concentration or composition of the sample, making it impossible to achieve reproducible results.

This study demonstrates how the torque of the storage tube cap affects sample attrition due to repeated thawing and freezing. Changes in sample weight were recorded after each cycle.

Materials

1. Thermo Scientific Matrix 1.0 mL 2D barcoded, V-bottom, ScrewTop tubes (Cat. No. 3741).
2. Thermo Scientific Matrix1000 µL Single-channel Manual Pipette (Cat. No. 1204)
3. Quality Biological™ Eagle's Minimal Essential Media (Cat No. 112-016-101)
4. Acros® Glycerol (Cat. No. 15892-0010)
5. MP Biomedicals Rabbit Serum (Cat. No. 191357)
6. LITL Microplate Defroster
7. Mettler Toledo® Analytical Balance AG245
8. Liquid nitrogen, large container

Method

Twenty-four Matrix® ScrewTop tubes (figure 1) were filled with a 1.0 mL solution of Eagle's Minimal Essential Media with 10% glycerol and 10% rabbit serum.

Eight tubes each were tightened to a torque of 4, 8, and 12 ounce•inches (2.8, 5.6, and 8.5 Ncm, respectively) and placed in a -80 °C freezer for 1 hour prior to being placed in a large container of Vapor Phase Liquid Nitrogen (VPLN) for at least 2 hours. To facilitate thawing, the tubes were placed on a microplate defroster that blew air at ambient temperature across the bottom of the tubes for approximately 1.5 hours.

The tubes were then wiped down to remove condensation, inspected for crazing and cracking, and weighed. The freeze-thaw cycles were repeated for a total of 20 cycles.

Results

After 20 freeze-thaw cycles, the eight tubes tightened to a torque of 12 oz•in lost little of their weight (0.01%). The eight tubes tightened to a torque of 8 oz•in lost approximately 0.02% of their total weight, while the tubes tightened to a torque of 4 oz•in suffered a loss of just under 0.6%.

Conclusion

The sample volumes lost from the caps tightened to 8 oz•in and 12 oz•in are shown to be within the balance tolerances over the 20 cycles (Figure 1), because sample volumes remained relatively constant for tubes with caps tightened to both 8 oz•in and 12 oz•in torque, there is no significant advantage to tightening caps to 12 oz•in torque vs 8 oz•in.

The tubes with caps tightened only to 4 oz•in, however, were shown to lose a significant sample volume after each freeze-thaw cycle. Comparing the caps tightened to 4 oz•in to those tightened to 8 oz•in tubes clearly demonstrates that the higher torque minimizes sample loss over a large number of freeze-thaw cycles, thereby preserving sample integrity during cryogenic storage.

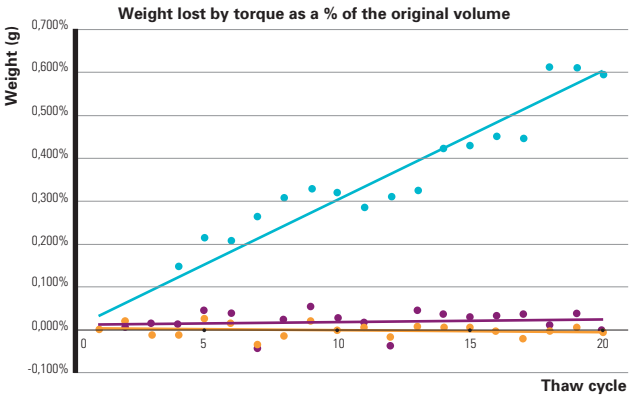

Table 1. Sample weight loss 4 oz•in 8 oz•in 12 oz•in

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