

USP <671> Containers -Performance Testing

USP 34

Hemant N. Joshi, Ph.D., MBA

Tara Innovations LLC

Parsippany, NJ

hemantjoshi@tarainnovations.com

www.tarainnovations.com

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Topics covered

- General information
- Multiple Unit Containers for Capsules and Tablets (Moisture permeation rate)
- Multiple Unit Containers for Capsules and Tablets (without closure in PE and PP containers)
- Single Unit/Dose Containers for Capsules and Tablets (water permeation rate)
- Single/Multiple Unit Containers for Liquids (water weight loss)
- Light Transmission Test

General Information

- It is the purpose of USP 671 to provide standards for the functional properties of containers and their components used to package regulated articles – pharmaceuticals, biologics, dietary supplements and devices.
- Revised on May 2011.

Torque Applicable to Screw-type Containers

Closure Diameter, mm	Torque, inch-pounds	Closure Diameter, mm	Torque, inch-pounds
8	5	43	17-27
10	6	48	19-30
13	8	58	23-40
15	5-9	63	25-43
20	8-12	66	26-45
24	10-18	70	28-50
28	12-21	83	32-65
30	13-23	89	40-70
33	15-25	120	55-95
38	17-26	132	60-95

Multiple-Unit containers for capsules/tablets

- If the interior of the container is more than 63 mm in depth, an inert filler or spacer may be placed in the bottom. Desiccant layer NLT 5 cm in depth.
- Close the containers immediately applying designated torque.
- Add glass beads to the two control containers. The weight of beads is equal to that of desiccant added to the test containers.

Multiple-Unit containers for capsules/tablets

- Record the weight of each container to nearest 0.1 mg, if the volume is <20 mL or to nearest 1 mg, if the volume is 20 mL-200 mL and to nearest 10 mg, if the volume is >200 mL.
- Store the containers at $23\pm 2^{\circ}\text{C}$ and at $75\pm 3\%$ relative humidity for 336 ± 1 hours (14 days).
- Record the weights after 14 days.

Multiple-Unit containers for capsules/tablets

- Find the volume of 5 containers using water.
- Calculate the moisture permeability in mg/day/L by the formula:

$$P = (1000/14V)[(Tf-Ti)-(Cf-Ci)]$$

where V is the volume of container in mL, (Tf-Ti) is the difference, in mg, between the final and initial weights of each test container and (Cf-Ci) is the difference, in mg, between the average final and average initial weights of the 2 controls.

Multiple-Unit containers for capsules/tablets

- Containers are considered *tight* if not more than 1 of the 10 test containers exceeds 100 mg/day/L in moisture permeability, and none exceeds 200 mg/day/L.
- Containers are considered *well-closed* if not more than 1 of the 10 test containers exceeds 2000 mg/day/L in moisture permeability and none exceeds 3000 mg/day/L.

Multiple-Unit containers for capsules/tablets (without Closures)

- Polyethylene container – Fit the container with impervious seals obtained by heat-sealing the bottles with aluminum foil-polyethylene laminate or other suitable seal.
- HDPE containers meet the requirements if P exceeds 10 mg/day/L in not more than 1 of the 10 test containers and exceeds 25 mg/day/L in none of them.

Multiple-Unit containers for capsules/tablets (without closures)

- LDPE containers meet the requirements if the P exceeds 20 mg/day/L in not more than 1 of the 10 test containers and exceeds 30 mg/day/L in none of them.
- In the case of polypropylene containers, they meet the requirements if P exceeds 15 mg/day/L in not more than 1 of the 10 test containers and exceeds 25 mg/day/L in none of them.

Single-Unit containers for capsules/tablets

- Desiccant – Use pellets weighing ~400 mg each and having a diameter of ~ 8 mm. Dry them at 110°C for 1 hour. (for small unit-dose containers, pellets weighing <400 mg or having diameter of <8 mm may be used.)

Method I –

- Seal not fewer than 10 unit-dose containers with 1 pellet in each and seal 10 additional empty containers. Use finger cots or padded forceps to handle the sealed containers.
- Weigh individual test container and weigh the controls as a unit and determine the average weight.

Single-Unit containers for capsules/tablets

- Store all the containers at $23 \pm 2^\circ\text{C}$ and $75 \pm 3\% \text{RH}$. Weigh the samples and record the weights.

$$P = (1/N)[(W_f - W_i) - (C_f - C_i)]$$

where N is the number of days expired in the test period; $(W_f - W_i)$ is the difference, in mg, between the final and initial weights of each test container; and $(C_f - C_i)$ is the difference, in mg, between the average final and average initial weights of the control. Calculate data to 2 significant figures.

Single-Unit containers for capsules/tablets

- If P is less than 5 mg/day and where the controls are observed to reach equilibrium within 7 days, P is calculated using 7-day test container and control container weights as W_i and C_i , respectively. The test interval is 7 days (initial) plus 28 days (a total of 35 days).

Single-Unit containers for capsules/tablets

Method II –

This is used for packs that incorporate a number of separately sealed unit-dose containers or blisters. Use not less than 4 packs or not fewer than 10 unit-dose containers and an equal number of empty packs.

- Store all the containers at $23 \pm 2^{\circ}\text{C}$ and $75 \pm 3\% \text{RH}$. Weigh the samples and record the weights.

Single-Unit containers for capsules/tablets

$$P = (1/NX)[(Wf - Wi) - (Cf - Ci)]$$

where N is the number of days expired in the test period, X is the number of separately sealed units per pack; (Wf - Wi) is the difference, in mg, between the final and initial weights of each test pack; and (Cf - Ci) is the difference, in mg, between the average final and average initial weight of control packs.

Single-Unit containers for capsules/tablets

- Method I – Samples are designated as *Class A* if not more than 1 of 10 containers tested exceeds 0.5 mg/day in moisture permeation rate and none exceeds 1 mg/day.
- Samples are designated *Class B* if not more than 1 of 10 containers tested exceeds 5 mg/day and none exceeds 10 mg/day;
- Samples are designated as *Class C* if not more than 1 of 10 containers tested exceeds 20 mg/day and none exceeds 40 mg/day.
- Samples are designated as *Class D* if the containers tested meet none of the moisture permeation rate requirements.

Single-Unit containers for capsules/tablets

- Method II – Samples are designated *Class A* if no pack tested exceeds 0.5 mg/day in average blister moisture permeation rate.
- Samples are designated *Class B* if no pack tested exceeds 5 mg/day in average blister moisture permeation rate.
- Samples are designated *Class C* if no pack tested exceeds 20 mg/day in average blister moisture permeation rate.
- Samples are designated *Class D* if the packs tested meet none of the average blister moisture permeation rate requirements.

Single-Unit containers for capsules/tablets

- As stated for Method I and Method II, after every 24 hours, the test and control containers or packs are weighed; and suitable test intervals for the final weighing, W_f and C_f are as follows: Class A – not less than 28 days, Class B – 7 days, Class C – 48 hours and Class D – 24 hours.

Multiple-Unit Containers and Unit-Dose Containers for Liquids

- This test measures the liquid water weight loss as a percent of the contents.
- Determine weights of individual container-closure systems including bottle, innerseal (if used), and closure.
- If container volume is <200 mL, weigh to the nearest 0.1 mg; if the volume is between 200 mL to 1000 mL, weigh to the nearest mg; and if the volume is >1000 mL, weigh to the nearest centigram (10 mg).

Multiple-Unit Containers and Unit-Dose Containers for Liquids

- Select 12 bottles, clean the sealing surface, fit each bottle with a seal, closure liner (if applicable) and closure, number and record the tare weight of each bottle.
- Open 10 bottles, and fill with water to the fill capacity. Place the closures and apply designated torque. Open 2 control bottles and fill with glass beads to the same approximate weight of the filled test container.
- Store the bottles at $25 \pm 2^\circ\text{C}$ and $40 \pm 2\% \text{RH}$. After 336 ± 1 hours (14 days), weigh the bottles and calculate the water weight loss rate, in percent per year.

Multiple-Unit Containers and Unit-Dose Containers for Liquids

$$\text{Percent/year} = \frac{(W1i - Wt) - (W14i - Wt) - (WC1 - WC14)365}{(W1i - Wt)14} \times 100$$

Where W1i is the initial weight of each bottle, Wt is the tare weight, W14i is the weight of each bottle at day 14, (WC1-WC14) is the average weight change of controls from initial to 14 days.

The containers are considered *tight* if the % water weight loss does not exceed 2.5% per year in not more than 1 of the 10 test containers and does not exceed 5.0% per year in none of them.

Light Transmission Test

- Apparatus – Spectrophotometer; adapted for measuring the amount of light transmitted by either transparent or translucent glass or plastic materials used for pharmaceuticals containers.
- Procedure – Cut circular sections from two or more areas of the container. Wash and dry each sample taking care not to scratch the surfaces.
- Mount the specimen on the spectrophotometer and measure the transmittance of the section at intervals of ~ 20 nm in the region 290 to 450 nm.

Light Transmission Test

- If the specimen is too small to cover the opening of the specimen holder, mask the uncovered portion of the opening with opaque paper or masking tape, provided that the length of the specimen is greater than that of the slit in the spectrophotometer.
- Keep the light beam normal to the surface of the specimen and keep reflection losses at a minimum.

Light Transmission Test

- The observed light transmission does not exceed the limits given in the following table intended for parenteral use. Limits for Plastic Classes I-VI and Glass Types I, II and III.

Size, mL	% Light transmission at any wavelength between 290 and 450 nm
1	25
2	20
5	15
10	13
20	12
50	10

Light Transmission Test

- The observed light transmission for plastic containers for products intended for oral or topical administration does not exceed 10% at any wavelength in the range from 290 nm to 450 nm.