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TPP TubeSpin® Bioreactor 50: Conical vs Round Tube Bottom

The TPP TubeSpin® bioreactor 50 mL is available with either a round “U” bottom (#87050) or a conical “V” bottom (#87056). The choice of bottom design can influence cell cultivation as well as downstream processes such as cell harvesting or supernatant collection by centrifugation.

TPP recommends a shaking diameter of 50 mm, as a larger diameter increases the oxygen transfer rate (OTR) at a constant speed (RPM) (refer to the TechDoc available from TPP). If a 50 mm shaking diameter is not feasible, TPP advises testing and optimizing the cell culture conditions accordingly.

A study investigated the impact of tube bottom design, media volume, inclination angle, and shaking speed on CHO cell cultures over 14 days. The experiment used a shaking diameter of 25 mm at 210 rpm. The results highlight a correlation between shaking speed, media volume, and inclination angle.

1. CHO cells cultivated in 15 mL medium

CHO cells were cultured in 15 mL of media for 14 days in TPP TubeSpin® 50 mL bioreactors, equipped with either a round “U” bottom or a conical “V” bottom, and placed in a test tube holder with an adjustable inclination angle. The incubator shaker operated with a 25 mm shaking diameter at a speed of 210 rpm (Table 1).

Viable and total cell counts were determined before subcultivation using the Vi-Cell XR. CHO cells were inoculated into the TPP TubeSpin® bioreactors with an initial cell density of 5×10^5 viable cells/mL on Mondays and Wednesdays, and 3×10^5 viable cells/mL on Fridays.

Table 1: Shaking parameters used for TPP TubeSpin® 50 mL bioreactors with round “U” and conical “V” bottoms.

TPP TubeSpin® bioreactor 50	Conical “V” (order-no.: 87050) Round “U” (order-no.: 87056)
Shaking speed rpm	210
Shaking diameter mm	25
Working volume mL	15
Inclination angle	0° 35°

CHO cells in 15 mL culture media showed no differences in cell growth and viability between conditions with or without inclination angle (35° or 0°) and between TPP TubeSpin® bioreactor 50 mL either with a round “U” or with a conical “V” bottom (Figure 1).

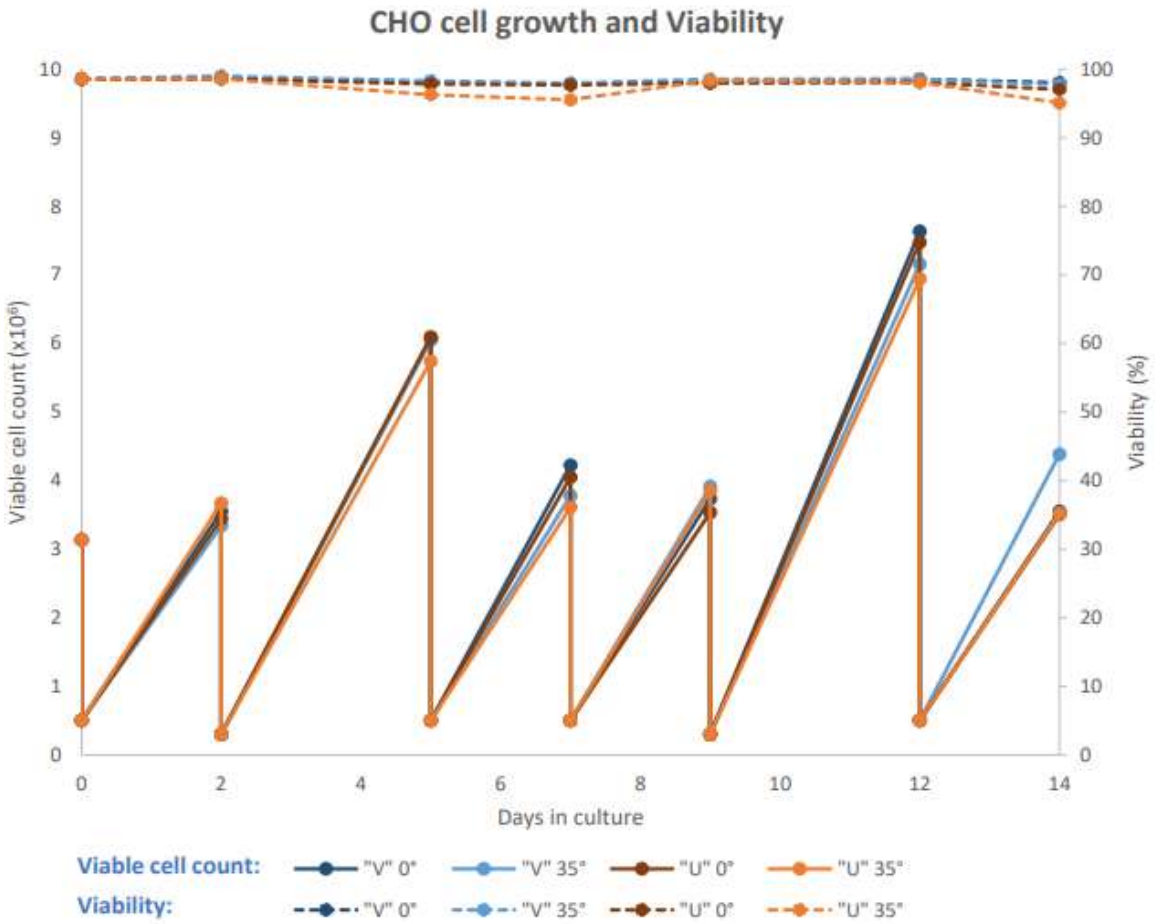

Figure 1: CHO cells were cultivated in TPP TubeSpin® bioreactors 50 mL either with a round "U" or with a conical "V" bottom with an inclination angle of 0° and 35° alternatively. CHO cells were cultivated in a 15 mL media volume for 14 days with a shaking diameter of 25 mm and a speed of 210 rpm. The viable cell count and viability were determined by Vi-Cell XR. The subcultivation schedule was Monday – Wednesday – Friday.

2. CHO cells cultivated in 30 mL medium

CHO cells were cultured in 30 mL media for 14 days in TPP TubeSpin® bioreactors 50 mL either with a round "U" or with a conical "V" bottom in a test tube holder with adjustable inclination angle. The incubator shaker featured a shaking diameter of 25 mm and a shaking speed of 210 rpm (Table 2). The number of viable cells and total cells was determined before subcultivation by Vi-Cell XR. CHO cells were inoculated in TPP TubeSpin® bioreactors with an initial cell density of 5×10^5 viable cells/mL on Monday and Wednesday and 3×10^5 viable cells/mL on Friday.

Table 2: Shaking parameter used with TPP TubeSpin® bioreactor 50 either with a round “U” or with a conical “V” bottom

TPP TubeSpin® bioreactor 50	Conical “V” (order no: 87050) Round “U” (order no: 87056)
Shaking speed rpm	210
Throw mm	25
Working volume mL	30
Inclination angle	0° 35°

CHO cells in 30 mL culture medium and 0° inclination angle, settled in the bottom of TPP TubeSpin® bioreactor 50 mL either with a round “U” or with a conical “V” bottom. This leads to reduced viability and slower cell growth. The conical “V” bottom showed earlier cell settling. In contrast, cultivation with an inclination angle of 35° showed equivalent results with no loss of viability and expected cell growth (Figure 2).

Further tests showed that increasing the shaking speed to 230 rpm allows for cultivation in 30 mL with 0° inclination angle (data not shown).

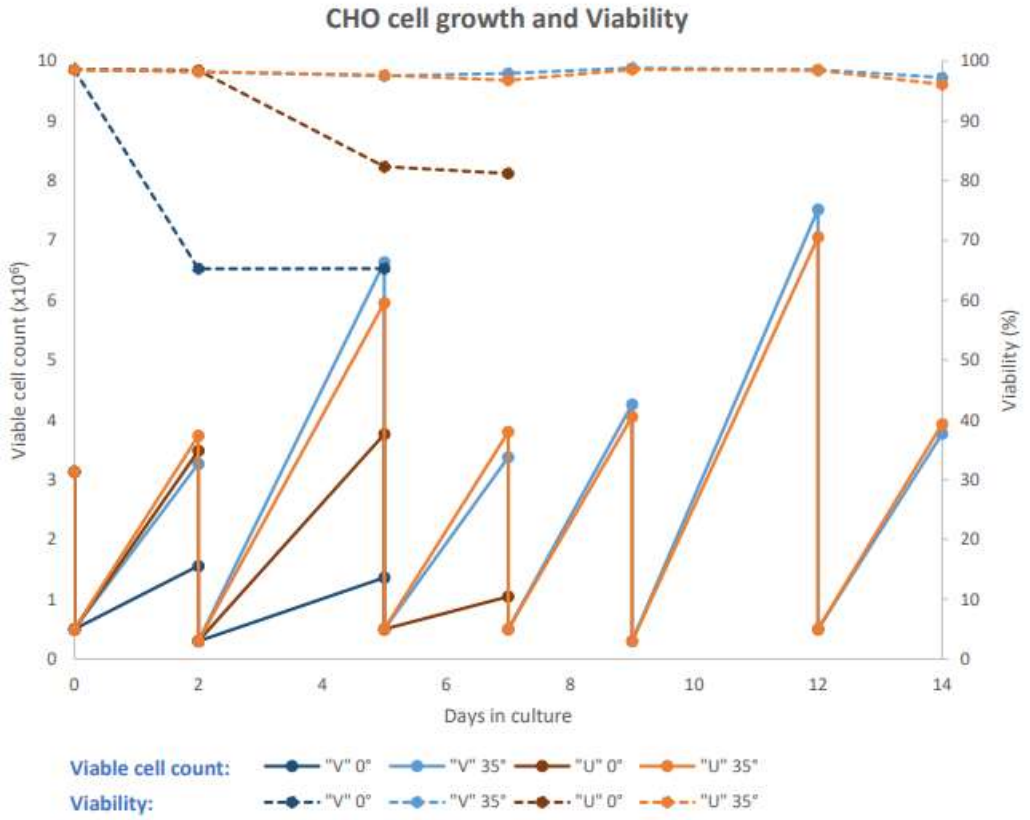

Figure 2: CHO cells were cultivated in TPP TubeSpin® bioreactors 50 mL either with a round “U” or with a conical “V” bottom and an inclination angle of 0° and 35°. CHO cells were cultivated in a 30 mL

media volume for 14 days with a shaking diameter of 25 mm and a speed of 210 rpm. Viable cell count and the viability were determined by Vi-Cell XR. The passage schedule was Monday - Wednesday - Friday.

Summary of the Results:

CHO cells were cultivated in 15 mL medium with an inclination angle of 0° and 35°, a shaking speed of 210 rpm and a shaking diameter of 25 mm in TPP TubeSpin® bioreactors 50 mL either with a round "U" or with a conical "V" bottom

- ✓ Expected performance and equivalent results for cell growth and viability

CHO cells were cultivated in 30 mL medium with an inclination angle of 0°, a shaking speed of 210 rpm and a shaking diameter of 25 mm in TPP TubeSpin® bioreactors 50 mL either with a round "U" or with a conical "V" bottom

- ✓ Cells settled in the bottom of the tube
- ✓ Conical bottom conditions lead to earlier cell settling
- ✓ Loss of viability and slower cell growth
- ✓ A cultivation in 30 mL with a 0° inclination angle without loss of viability is possible by increasing the in shaking speed from 210 rpm to 230 rpm

CHO cells were cultivated in 30 mL medium with an inclination angle of 35°, a shaking speed of 210 rpm and a shaking diameter of 25 mm in TPP TubeSpin® bioreactors 50 mL either with a round "U" or with a conical "V" bottom

- ✓ No settling of the cells, normal cell growth and viability
- ✓ No difference between conical or round bottom tubes

Technical Data TPP TubeSpin® bioreactor 50 mL

Materials

Screw cap	PE
Membrane	PTFE
Tube	PP

Measurements	**87050**	**87056**
Volume graduation mL	50	50
Length mm	115	115
Diameter mm	30	30
Max. RCF x g	15'500	15'500
Form	"V" conical	"U" round
Optimal filling volume mL	5 – 35	5 – 35
Shaker recommendations: Shaking diameter (orbit / throw) mm	50	50
Shaker recommendations: Speed rpm	180	180

Disclaimer

TPP products are for research use only and not for clinical, diagnostic or therapeutic use. All products are intended for use by trained personnel that are familiar with safe laboratory practices.

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