TPP Techno Plastic Products AG
Zollstrasse 7, CH-8219 Trasadingen, Switzerland
Tel. +41 (0)52 687 01 87, Fax +41 (0)52 687 01 77
info@tpp.ch, www.tpp.ch

TPP TubeSpin® Bioreactor 50: Conical vs Round Tube Bottom

The TPP TubeSpin® Bioreactor 50 mL is available either with a round "U" (# 87050) or with a conical "V" (# 87056) bottom. The choice of the Bioreactor bottom may influence the cultivation of the cells as well as the subsequent steps, such as harvesting cells or supernatant by centrifugation.

TPP recommends a shaking diameter of 50 mm, as larger diameters yield higher oxygen transfer rates (OTR) at a constant shaking speed (RPM) (see: *TechDoc Bioreactor 15 / 50 – Shaking Recommendations*). In cases where the recommended 50 mm diameter cannot be employed, TPP advises that cell culture conditions be carefully tested and optimized.

A study tested the influence of the selected tube bottom, media volume, inclination angle, and shaking speed by culturing Chinese hamster ovary (CHO) cells for 14 days with a shaking diameter of 25 mm and a speed of 210 rpm. The results demonstrate a correlation between shaking speed, media volume and the selected inclination angle.

1. CHO cells cultivated in 15 mL medium

CHO cells were cultured in 15 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 an adjustable inclination angle. The incubator shaker featured a shaking diameter of 25 mm, and the shaking speed was set to 210 rpm (Tab. 1). The number of viable cells and total cells were 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 1. Shaking parameter used with TPP TubeSpin® Bioreactor 50 mL round "U" and conical "V" bottom

TPP TubeSpin® Bioreactor 50	Conical "V" (# 87050) Round "U" (# 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 (Fig. 1).

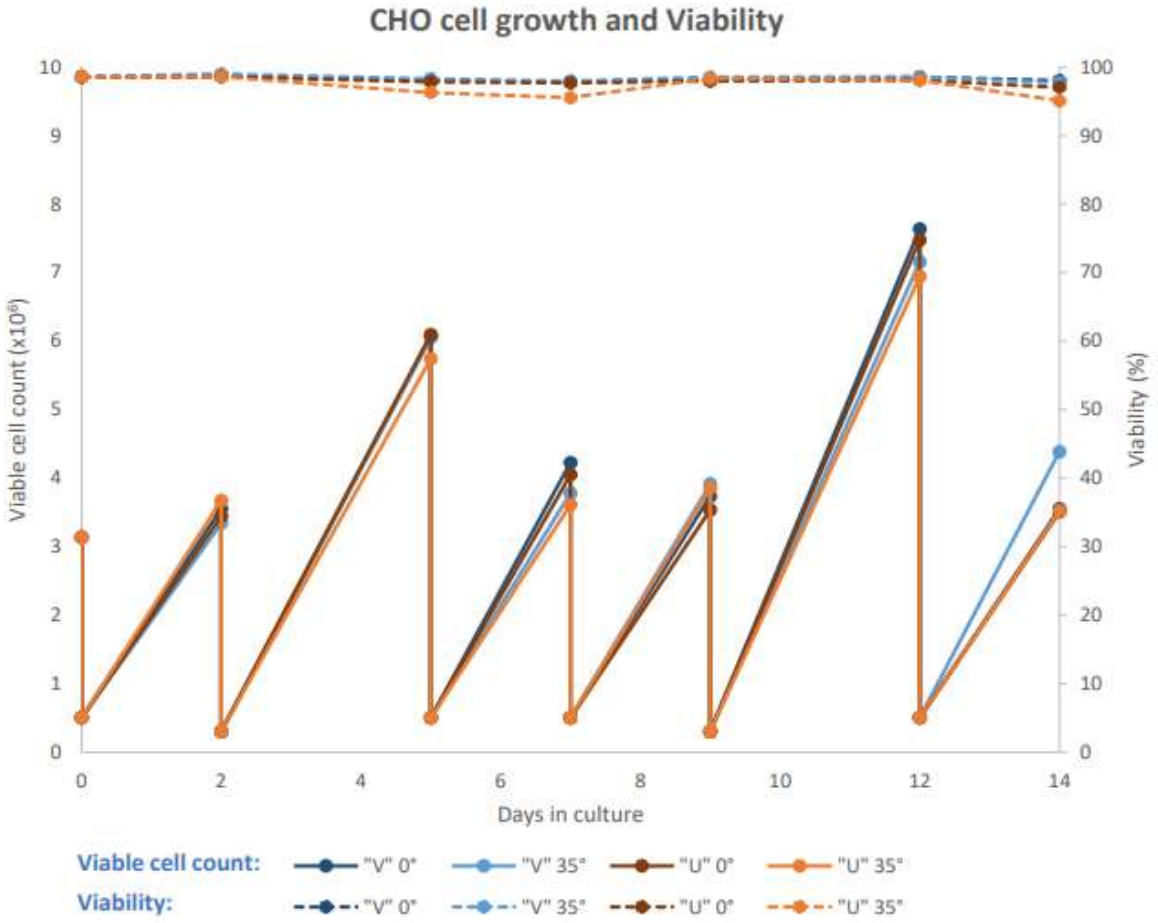

Figure 1. CHO cells were cultivated in TPP TubeSpin® Bioreactors 50 mL either with a round "U" or with a conical "V" bottom with an inclination angle of 0° and 35° alternatively. CHO cells were cultivated in a 15 mL media volume for 14 days with a shaking diameter of 25 mm and a speed of 210 rpm. The 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 (Tab. 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" (# 87050) Round "U" (# 87056)
Shaking speed rpm	210
Shaking diameter 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 (Fig. 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).

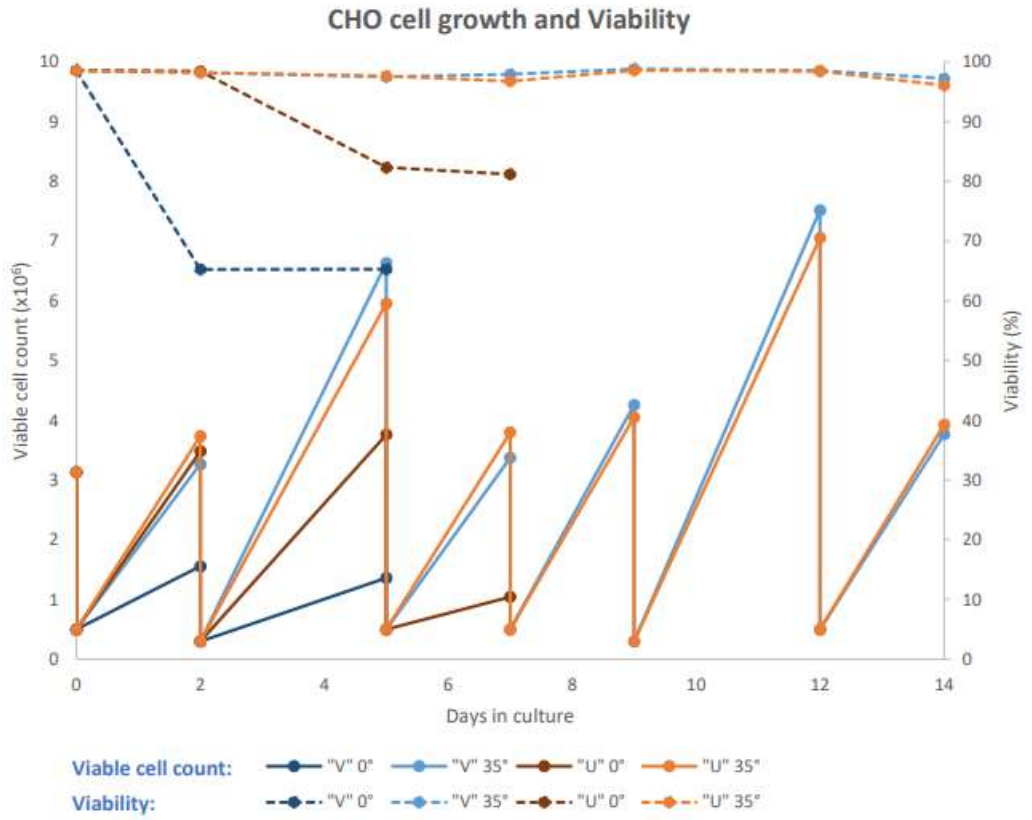

Figure 2. CHO cells were cultivated in TPP TubeSpin® Bioreactors 50 mL either with a round "U" or with a conical "V" bottom and an inclination angle of 0° and 35°. CHO cells were cultivated in a 30 mL media volume for 14 days with a shaking diameter of 25 mm and a speed of 210 rpm. Viable cell count 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

Component	**Material**
Screw Cap	Polyethylene (PE)
Membrane	Polytetrafluoroethylene (PTFE)
Tube	Polypropylene (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 fill volume mL	5 – 35	5 – 35
Shaker: Recom. orbit / shaking diameter mm	50	50
Shaker: Recom. speed RPM	180	180

Disclaimer

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