Thermo Scientific DynaSpin Single-Use Centrifuge

Introduction

We are committed to designing our products with the environment in mind. This fact sheet provides the rationale behind the environmental claim that the Thermo Scientific™ DynaSpin™ Single-Use Centrifuge generates up to 69% less filter waste and 74% less liquid waste relative to traditional depth filtration workflows. The resulting material and equipment reduction can shrink the manufacturing suite footprint by up to 32% and the warehouse space footprint by up to 78%.

Product description

The DynaSpin Single-Use Centrifuge is used for cell harvest unit operation in bioproduction workflows to support recombinant protein, monoclonal antibody and bioengineered vaccine production applications (Figure 1). It increases filter capacity and is a scalable solution that allows process volumes from 50 to 5,000 L. It replaces the first depth filtration stage with a centrifugation step and helps reduce the number of filters needed for the second depth filtration stage. It also adds efficiency, especially at larger scales where multiple units can be organized in a daisy chain to optimize volumetric pulldown time from the bioreactor.

The DynaSpin consumable is composed of a rotor and tube set that implements disk stack technology and three-line sets with integrated best-in-class sensors that allow analysis and control of critical process parameters. It has one inlet line where cell culture fluid is supplied to the rotor and two outlet lines that carry the separated product (centrate) and concentrate streams. Each line set contains appropriate sensors that communicate with the hardware via firmware on the built-in touchscreen. The DynaSpin hardware is a user-friendly device that can be set up and operational in a matter of minutes. This product delivers superior separation and next-generation automation.

Figure 1. Thermo Scientific™ DynaSpin™ Single-Use Centrifuge.

Green feature

Less waste

Traditionally, the depth filtration process consists of two filtration stages: one for primary filtration and a second filtration to reach the purification parameters required by the process. In general, depth filters scale up well until large volumes force scaling out. The DynaSpin centrifuge increases filter capacity and therefore helps reduce the number of filter supplies needed (Figure 2).

A comparison of an average 5,000 L process run with the DynaSpin centrifuge against a traditional depth filtration workflow showed that the traditional depth filtration produces approximately 1,448 kg of plastic waste, compared to 447 kg of waste with the DynaSpin centrifuge (Table 1)—a 69% reduction in plastic waste. Performing the assay shown in Table 1 once every month over the course of one year would translate to a total of roughly 12,000 kg of plastic waste avoided annually by choosing the DynaSpin centrifuge over traditional depth filtration.

Additionally, a comparison of an average 5,000 L process run using the DynaSpin centrifuge instead of the traditional depth filtration workflow showed a reduction in water for injection (WFI), buffer and NaOH use as well as the corresponding waste. The traditional depth filtration results in 13,800 L of liquid waste, compared to 3,542 L of liquid waste generated with the DynaSpin centrifuge (Table 2). Using the DynaSpin represents a 74% reduction in liquid chemical waste. Performing the assay shown in Table 2 once every month over the course of one year would translate to a total of approximately 123,000 L of liquid chemical waste avoided annually by choosing the DynaSpin centrifuge over traditional depth filtration.

Table 1. Comparison of plastic waste generated using a traditional depth filtration workflow versus a DynaSpin centrifuge at 5,000 L scale.

Steps in procedure and materials used					
Procedure step number	Procedure step	Material description	Quantity used	Unit mass (kg)	Total mass (kg)
1	Install primary depth filters	Primary depth filters	85	11.4	969.0
2	Install secondary depth filters	Secondary depth filters	42	11.4	478.8
				Total mass	1447.8
Steps in procedure and materials used					
Procedure step number	Procedure step	Material description	Quantity used	Unit mass (kg)	Total mass (kg)
1	Install DynaSpin rotor	Centrifuge rotor	2	7.1	14.2
2	Install secondary stage depth filters	Depth filters	38	11.4	433.2
				Total mass	447.4
Reduction in filter waste mass					69%

Reducing the number of filters needed also decreases the required unit operation footprint. With the DynaSpin, fewer filter housings or racks are needed in a manufacturing suite, shrinking the process footprint. Traditional depth filtration for tested cultures at the 2,000 L scale would require an average footprint of 10.4 m^2. Utilizing DynaSpin, these processes would require an average footprint of 7.9 m^2 resulting in a 2.5 m^2 footprint reduction (Table 3). This footprint includes a single-use mixer for product collection, a single-use mixer for WFI, depth filter racks, DynaSpin units, 1,000 L totes for chase buffer and pumps. The efficient use of cleanroom suite area provided by DynaSpin enables users to potentially reduce energy use along with the operation footprint.

Facility footprint savings also extend beyond the suite. Warehouse space is often limited for sites expanding their production capabilities. Consumables used in high numbers—such as depth filters—result in significant warehouse storage space requirements. Reducing the number of consumables in the process allows for reduced physical inventory. The reduction in filter area from one 2,000 L harvest equates to nearly two [2] full pallets or 1.8 m^2 of warehouse space (Table 3) freed up.

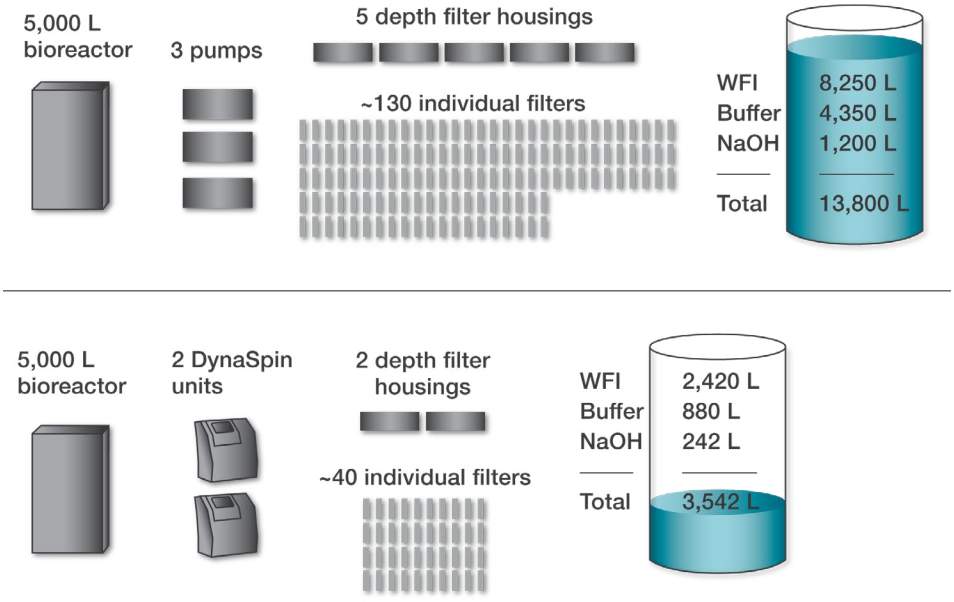

Figure 2. Comparison of traditional harvest requirements at 5,000 L scale (top) compared to a 5,000 L process using the DynaSpin centrifuge (bottom).

Table 2. Comparison of liquid waste generated using a traditional depth filtration workflow versus a DynaSpin centrifuge at 5,000 L scale.

Water and chemicals needed to flush filters	Traditional depth filtration (liquid waste, L)	DynaSpin Single-Use Centrifuge (liquid waste, L)	Reduction in liquid waste with DynaSpin Single-Use Centrifuge
WFI	8,250	2,420	70%
Buffer	4350	880	80%
NaOH	1,200	242	80%
Total	**13,300**	**3,542**	**74%**

Table 3. Comparison of operation footprint using a 2,000 L traditional depth filtration workflow versus a DynaSpin centrifuge.

	Manufacturing suite footprint (m^2)	Warehouse space footprint (m^2)
Traditional depth filtration	10.4	2.3
DynaSpin Single-Use Centrifuge	7.9	0.5
Reduction with DynaSpin Single-Use Centrifuge (%)	**24.0%**	**78.3%**

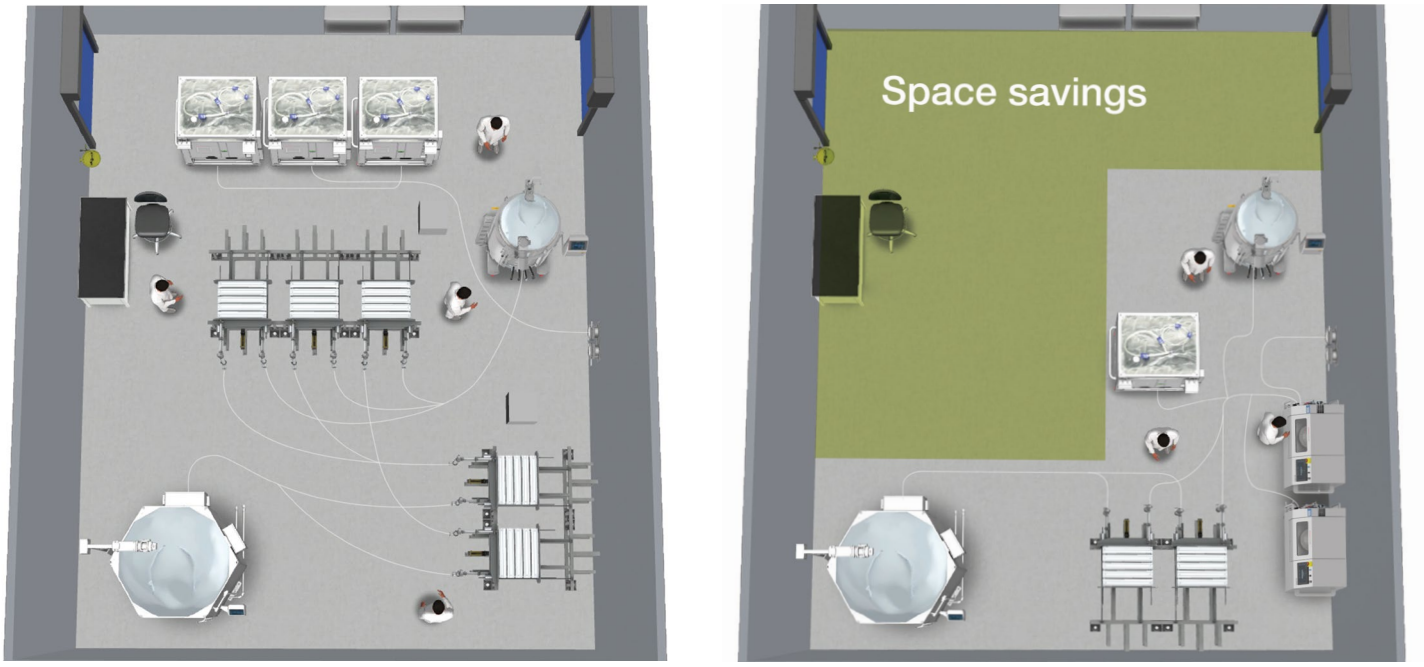

Figure 3. Comparison of manufacturing harvest suite layout for a 5,000 L scale. Layout for traditional harvest requirements (Left) at this scale compared to a process using the DynaSpin centrifuge, shown (Right).

Table 4. Extrapolated comparison of operation footprint using a 5,000L traditional depth filtration workflow versus a DynaSpin centrifuge.

	Manufacturing suite footprint (m^2)	Warehouse space footprint (m^2)
Traditional depth filtration	17.8	5.8
DynaSpin Single-Use Centrifuge	12.0	1.5
Reduction with DynaSpin Single-Use Centrifuge (%)	**32.6%**	**74.1%**

Relative to the example above for a 2,000 L use case, the benefits of utilizing DynaSpin are compounded at larger scales. Extrapolating to a 5,000 L scale, six filter holders would be required for harvest using traditional two-stage depth filtration; the DynaSpin brings this number down to a single individual filter holder. Figure 3 provides a visual comparison of the harvest methods and manufacturing footprints.

Eliminating five filter holders from the harvest suite creates ample space for a second DynaSpin unit, allowing facilities to maintain a single shift harvest at the 5,000 L scale. The benefits of DynaSpin compared to two-stage filtration are amplified at larger scale, expanding the differential of footprint and total process time between the two methodologies (Table 4).

Designing the DynaSpin centrifuge to generate significantly less plastic and liquid waste while also reducing the required operational footprint is a win for our customers, our company and the planet.

Find out more at **thermofisher.com/dynaspin**