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The Appeal of Single-use Tech

30 November 2022 | Features | By Sanjiv Das

Single-use technology is the new norm in the pharma manufacturing process due to an array of benefits. The availability of this technology has made new biopharmaceutical companies adopt single-use systems, as it requires less upfront capital investment and enables quick advancement of development efforts towards new products. Having an upper hand, the single-use technology is vouched to be a game changer in the entire manufacturing process.

A single-use system (SUS) is biopharmaceutical manufacturing (bioprocessing) equipment that is designed to be used once (or for a single manufacturing campaign) and then discarded. Pharma companies are adopting single-use technology (SUT) to speed up the manufacturing process and discard the stainless steel equipment that has been in use for quite some time. Contract manufacturing organisations (CMOs) were amongst the earliest adopters of SUT and over the past decade, SUT has been adopted increasingly by a majority of Indian manufacturers.

Single-use bioreactors, single-use bags, filters, etc. are used for some time and are used commonly whereas perfusion devices, membrane adsorbers, powder handling systems, disposable chromatography devices, TFF systems, virus filtration systems are newer and expensive products. These are at the lower end of adoption because the products tend to be newer and more expensive. SUS equipment is typically made up of gamma-irradiated, sealed, and disinfected plastic parts. These systems are manufactured in a cleanroom, double bagged, and sterilised using gamma, X-ray sterilisation methods, ensuring a sterile system for each batch.

The SUT market

According to a report in Research and Markets, the single-use bioprocessing market was valued at $7 billion in 2020 and is estimated to reach $38.8 billion by 2030, growing at a CAGR of 18.4 per cent from 2021 to 2030. The report also mentions that untapped markets like India and China hold huge promises for the market.

Based on product, the market is divided into bioreactors, tangential-flow filtration devices, depth filters, disposable filter cartridges, media bags and containers, mixing systems, tubing assemblies, sampling systems, and others.

In August 2022, US-based Repligen unveiled its new customer experience centre for bioprocessing in Bengaluru. Bioprocessing technologies from Repligen are designed to deliver configurable options for end-to-end modern bioprocessing needs. Through this customer experience centre, the company intends to focus on biopharmaceutical process efficiency and effectiveness through innovation in single-use technologies in India.

According to **Stephen K Tingley, Vice President, Sales, Repligen**, “SUTs can help in overcoming challenges such as cleaning, validation, contamination and bring a lot of advancements to the sophistication of the process. For instance, single-use chromatography systems can solve the yield, shear, and separation challenges of traditional systems, through expert engineering and technological innovation of both hardware and flow path, and recover more products with lower hold-up volume.”

PharmNXT recently unveiled its Pune facility where it will offer everything that goes into the workflow of the manufacturing of biotherapeutics for filtration, storage, Cll culture, mixing and purification, including mixer, storage, bioreactor bags, connectors, tubing assemblies etc.

Sachin Joshi, Founder, PharmNXT Biotech mentions, “This is growing at a rapid pace. The new facilities are being built keeping in mind the single-use solutions and the existing facilities are either modifying or adapting to the single-use. This is growing by almost 21 per cent. With an ever-growing pipeline of biosimilars, vaccines and regular biologics, the need for single-use solutions will only grow.”

In 2020, the Serum Institute of India selected ABEC's Custom Single Run (CSR) technology to accelerate large-scale, single-use manufacturing of nearly one billion doses of the Novavax vaccine, which is designed against COVID-19.

Biocon is among the early adopters of state-of-the-art single-use biomanufacturing technology in India. The company is one of the early adopters of single-use bioreactor technology in the country and has been leveraging this technology in its production facilities since 2010. In 2021, Biocon Biologics commissioned a new facility with state-of-the-art SUT to support its monoclonal antibody portfolio. The new facility when commercialised will support the future growth and drug development pipeline.

Says **Ganesh Reddy, Global Manufacturing Head, Biocon Biologics**, “As the global biosimilars space becomes more competitive in the coming years, Indian biologics manufacturers will increasingly adopt SUT as it offers lower costs and reduction in biomanufacturing process timelines. Moreover, the increasing global demand for personalised medicine will also lead to higher demand for SUT as its use avoids the risk of contamination.”

Thermo Fisher Scientific has unveiled the Thermo Scientific DynaSpin Single-Use Centrifuge system at the BioProcess International annual conference in Boston, MA recently. The DynaSpin system improves and streamlines harvesting for cell culture separation in single-use bioprocesses by reducing the number of depth filtration cartridges required to complete the harvest process. The DynaSpin solution delivers equivalent or improved product yield compared to traditional harvest systems while enabling operational efficiency, cost savings and sustainable practices in the production of biologics.

"With significant advantages over traditional, reusable stainless-steel systems, single-use technologies (SUTs) are gaining acceptance globally and are defining the future of biopharmaceutical processing. With a focus on strengthening its global presence in biologics and biosimilars, biomanufacturers in India are building their capabilities regarding quality, reducing production failures, and faster go-to-market strategies.

This was particularly seen during the COVID-19 pandemic when drug and vaccine manufacturers turned to single-use systems such as bioreactors, storage and product handling solutions, because of the benefits offered, including a reduction in capital investment and increased deployment of product and batch changeover while eliminating cleaning validation requirements.

Further, the trend in upstream processing is driven by a need for intensified cell cultures to improve the product titer. The HyPerforma DynaDrive Single-Use product line is our latest advancement in Single-use Technology, as it offers a host of advantages that include better performance and scalability to large volumes. Additionally, the use of a superior-quality film also eliminates the concern of extractables, leachables and other particles arising from the components used in single-use systems, which are critical for drug safety and stability.

With a growing need for optimisation of processes requiring high cell densities and more efficient processing steps, customers are seeking robust solutions in the harvesting step.

The global supply of single-use technologies is a challenge that Thermo Fisher is addressing by expanding its manufacturing capabilities and enhancing supply chain services", says

Amit Chopra, MD, India and South Asia, Thermo Fisher.

Benefits

Pharma companies have been able to realise the benefits and are using this form of technology to discard the loopholes and delays in the manufacturing process. The main benefit of single-use is the quick turnaround time, lean production process, and scheduling flexibility provided to the production floor, as well as the lower start-up cost. Once qualified and validated, the implementation time can be reduced.

The primary advantage of SUS over traditional stainless steel (or less commonly used glass in bioprocessing) is that the equipment is pre-sterilised, eliminating the need for cleaning, sterilisation, and sterilisation validation before use.

According to **Raheel Shah, Director, BDR Pharma**, the main benefit of SUT is the quick turnaround time, lean production process, and scheduling flexibility provided to the production floor, as well as the lower startup cost. Once qualified and validated, the implementation time can be reduced.

Single-use assembling speeds up the process by offering sterile, ready-to-use systems, allowing companies to develop products faster. Moreover, it saves costs on chemicals by eliminating the need for cleaning and sterilisation. Usage of SUT leads to making production smarter and cheaper, keeping the supply chain intact. The adoption of SUTs helps pharma companies rely on financial assets. It leads to cost reduction through time savings, energy savings, water savings; less instrumentation/utility demand required and lower investment sums.

SUT has gained considerable importance in biotechnology manufacturing over the years as it employs single-use components that lessen the need for resource-intensive cleaning and quality-control procedures. The higher flexibility offered by SUT means shorter turnaround times during a batch or product changeover. This is crucial given the complexity involved in manufacturing biosimilars, which results in long lead times. SUT also results in savings on the facility design, as well as starting up and qualification timelines. Moreover, tech transfer timelines from site to site are also significantly shorter due to the standard design of single-use manufacturing equipment.

Many companies take a hybrid approach using the combination of disposable and reusable stainless steel/glass equipment to overcome certain limitations of SUT, like operating process scale, the technical need of the unit operations, and cost-effectiveness. The availability of this technology has made new biopharmaceutical startups adopt SUS, as it requires less upfront capital investment and enables quick advancement of development efforts towards new products. The adoption of SUT positively impacts cost, quality, and time. The key benefits are lower capital expenditure, improved flexibility, speed and efficiency for multi product manufacturing, reduction in utility (energy and water), space requirement, cleaning validation efforts and shortened scale-up time.

Dr Cyrus Karkaria, President, Biotechnology, Lupin opines, “Based on the latest offerings in SUT and current growth trend, its application through hybrid approach (combination of stainless steel and single-use) will benefit Indian industry to set up a new facility with low initial capital investment. In the current scenario, the hybrid technology will give an advantage of cost-effectiveness, and overcome the risk associated with supply chain security and handling of high in-process volumes. In future, the maximisation of the use of SUT will be based on higher volumes, higher productivity, lower cost of manufacturing, the robustness of the supply chain, and expansion of SU supplier facility to manufacture and store SUS to meet demand and cost-effectiveness.”

Challenges

Some of the challenges that biosimilar manufacturers face include shortage of single-use components and assemblies. Regulatory clarity and understanding of the regulations for single-use bioreactor technology is a major challenge.

Other challenges include extractable & leachable (E&L), particulates, integrity assurance of large-size single-use consumables i.e upstream bioreactor bags, limitation to implement single-use chromatography systems and columns, supply chain security, longer lead times, high dependency of supplier on key starting material for SUS manufacturing, time taken to adopt during the change over to another single-use material MOC, alternate vendor development, cost-effectiveness and regulatory requirements etc.

The future

SUT has gained immense significance and will do so in the coming years. The application through a hybrid approach (combination of stainless steel and single-use) will benefit the Indian industry to set up new facilities with low initial capital investment. In the current scenario, the hybrid technology will give an advantage of cost-effectiveness, and overcome the risk associated with supply chain security and handling of high in-process volumes.

Dr Suresh Beri, Additional Director, Polysaccharide Conjugate Vaccine Division, Serum Institute of India mentions, "SUT is the need of the hour since there are a lot of issues associated with reuse abilities. It was a different scenario 5-10 years back in India when systems were re-used. But now single-use technologies are being preferred."

In future, the maximisation of the use of SUT will be based on higher volumes, higher productivity, lower cost of manufacturing, the robustness of the supply chain, and expansion of SU supplier facility to manufacture and store SUSs to meet demand and cost-effectiveness.

Pharma companies need to be aware of the benefits of SUT and help improve their production capabilities in the long run. Having said that, the APAC region is going to witness considerable market growth due to significant demand for bioprocess equipment including laboratory filtration systems and membrane-based microbial analysis among many others.

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