BioProcess Insight

How do equipment and consumables impact Scope 3 emissions?

Managing Scope 3 emissions in bioprocessing - Part II

Introduction

As Part I of this series identified the significance of Scope 3 emissions in bioprocessing, Part II explains how to evaluate the impact of technology on these emissions throughout their lifecycle. Specifically, we will examine how equipment and consumables contribute to Scope 3 emissions from production and transportation to usage and disposal. Assessing these activities is essential for identifying areas of improvement. This includes evaluating the carbon footprint of manufacturing, transportation emissions, environmental impact during usage, and disposal emissions. A thorough assessment enables companies to implement effective sustainable practices and reduce their environmental impact.

In Part I, we introduced the foundational concepts of Scope 3 emissions and their importance. Part II will delve into the contributions in bioprocessing concerning the equipment and consumables, while Part III will focus on strategies to manage and reduce these emissions effectively.

Assessing the impacts of equipment and consumables on Scope 3 emissions

1. Value chain: Mapping the entire value chain helps identify activities contributing to Scope 3 emissions (1).

- **Raw materials:** Analyze emissions from sourcing, extracting, transporting, and processing raw materials.
- **Manufacturing:** Identify manufacturing steps that contribute to GHG emissions.
- **Transportation and distribution:** Assess transportation modes and distribution distances from manufacturers to end-users.
- **Use-phase:** Evaluate energy, water, and resource consumption, as well as waste generation during the use.
- **End-of-life disposal:** Assess the disposal methods for equipment and consumables after use, including incineration, recycling, or landfill.

Here is an example of the value chain....

STAGE	EQUIPMENT	CONSUMABLES
Raw materials	Extraction of metals (e.g., stainless steel, aluminum)	Extraction of polymers
Manufacturing	Assembling components into equipment	Production and packaging
Transport and distribution	Shipping through multiple modes	Frequent shipments
Use-phase	Energy and water consumption	Regular use
Waste management and disposal	Recycling and disposal	Incineration, landfilling

2. Data collection and supplier engagement: Having mapped the value chain, the next step is accurate data collection. The data is fundamental to quantifying emissions and understanding the environmental impact of each stage. This requires data from suppliers, transportation providers, end-users, and waste management companies (1,4).

- **Supplier emissions:** Collect data on energy use and GHG emissions during extraction, processing, and manufacturing. Document their carbon reduction initiatives.
- **Transportation and distribution:** Track logistics details, including transportation modes, distances traveled, and fuel consumption to quantify the emissions for each segment.
- **Waste disposal:** Record waste types, quantities, and disposal methods, along with associated emissions.
- **Use of sold products:** Measuring emissions, usage patterns, and energy and resource consumption during use can help identify ways to reduce environmental impact through changes in usage behavior or product design. For example, a facility can optimize harvest steps to reduce the typical 5,800 L of water required to harvest 5,000 L of cell culture (5).

3. Emission factors and calculation: Emission factors, sourced from reputable databases like the Environmental Protection Agency (EPA) and Intergovernmental Panel on Climate Change (IPCC), convert activity data into GHG emissions. Accurate calculations require precise activity data and regular updates for reliable inventories and effective emissions reduction strategies. For example, if a bioprocessing facility uses 2,000 kg of single-use polypropylene filters annually, the Scope 3 emissions can be calculated as follows:

CO_2 emissions = Activity data × Emission factor

Scope 3 CO_2 emissions = 2,000 kg polypropylene × 1.9 kg CO_2/kg polypropylene 3,800 kg CO_2

4. Supplier engagement: Working closely with suppliers is crucial for obtaining accurate data and identifying emission hotspots. Collaborative efforts improve data quality and lead to more effective emission reduction strategies. Companies can partner with suppliers to adopt sustainable practices, such as using renewable energy or optimizing production processes.

5. Use of technology and tools: Advanced software tools and platforms can streamline data collection and calculation processes (1). These technologies integrate seamlessly with existing systems, automate data collection, and provide real-time emissions insights. Examples include lifecycle assessment (LCA) software and supply chain management platforms, which enhance efficiency and accuracy in tracking emissions data. These tools also support predictive analytics and scenario planning, enabling companies forecast the impact of strategies and make informed decisions to reduce their carbon footprint. Utilizing these technologies enhances transparency and accountability in their sustainability efforts.

Approaches to reducing Scope 3 emissions from equipment and consumables

To effectively reduce Scope 3 emissions, companies should focus on several high-impact approaches:

- **Supplier collaboration:** Work closely with suppliers to source sustainable materials and adopt greener manufacturing practices. Integrating biobased solutions can significantly lower Scope 3 emissions.
- **In-region manufacturing:** Prioritizing in-region manufacturing can substantially reduce fossil fuel consumption and transportation-related emissions.
- **Process optimization:** Optimize production processes by adopting advanced technologies to minimize waste and enhance efficiency, reducing waste and Scope 3 emissions.

In this Part II of the series, we examined the contributions of equipment and consumables to Scope 3 emissions in bioprocessing. We assessed the entire value chain, from raw material extraction to disposal, and emphasized the importance of accurate data collection and supplier engagement. These insights are crucial for identifying emission hotspots and developing targeted reduction strategies. In the next article, Part III, we will explore specific strategies and best practices for effectively reducing these emissions and achieving our sustainability goals.

References

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