

HARNESSING THE POWER OF SUSTAINABLE BIOMASS IN SINGLE-USE COMPONENT RESINS

As the biopharmaceutical industry moves towards a more environmentally responsible future, suppliers must also evolve into greener practices and products. Through sustainable resins and technological advancements, Carolina Components Group is spearheading change in single-use components used for drug production by combining innovative product design and materials.



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WHAT IS BIOMASS?

Biomass are organic materials derived from living, or recently living, organisms that can be used as a source of energy or for various industrial purposes. There are three separately identified generations of biomass content, categorized based on their production method and type of material used. First-generation biomass primarily comes from sources such as wood and edible crops, like corn or sugarcane. They provide a *"sure and economically viable approach for sustainability and reduction of fossil fuel consumption."* Second-generation biomasses are divided into three unique categories: homogenous, quasi-homogenous, and non-homogenous. These types of biomasses are more complex to convert than their first-generation counterparts and include non-food crops and agricultural residues. Third-generation biomass can effectively be narrowed down to algal biomass, which has the potential to produce high yields of oil which can be converted into biofuels. There are many challenges associated with algal biomass, particularly related to the large volumes of water required for industrial scale production².

FLOWLINX® TPE: ECO-FRIENDLY INNOVATION

In pursuit of eco-friendly materials, Carolina Components Group is incorporating Avient's first-generation biomass resin, Versaflex HC BIO BT218, into TPE overmolded products. Manufactured in state-of-the-art ISO 8 cleanrooms, FlowLinX® overmolded products maximize fluid flow and minimize the risk of leaks and contamination that commonly occur with hose barb fittings and tubing fasteners. Versaflex™ HC BIO BT218 offers, in addition to its low carbon footprint, *"weldability, kink resistance, and tensile strength performance comparable to leading medical tubing materials, including silicone and TPE"*



Figure 1 Avient's new Versaflex™ HC BIO TPE offers a sustainable alternative for biopharma tubing applications. Image courtesy of Avient Corporation.

Versaflex™ HC BIO BT218 is created using 40% first-generation bio-derived content. The result is a resin with a lower carbon footprint than standard alternatives. “The bio-derived grade offers greenhouse gas emissions at 2.35 kg CO₂e / kg product, a nearly 25 percent lower cradle-to-gate product carbon footprint (PCF) than Avient’s standard Versaflex™ HC BT218 grade,” says Avient.

The figure below explores the material properties between Avient’s Versaflex™ HC BT218 and Versaflex™ HC BIO BT218. As the figure demonstrates, the two materials have similar mechanical properties ensuring that form, fit, and function were not sacrificed in development of the sustainable TPE resin. Additionally, the TPE resin complies with global regulatory standards enabling flexibility and ease of implementation without compromising on quality.

VERSAFLEX™ HC & VERSAFLEX™ HC BIO TPES

	Unit	Versaflex HC BT218	Versaflex HC BIO BT218
Durometer Hardness	Shore A, 10 sec	67	70
Specific Gravity	-	0.89	0.88
Tensile Strength (Break, 73°F)	psi	1180	1190
Tensile Elongation (Break, 73°F)	%	600	630
Viscosity (392°F, 1340s-1)	Pa s	82	54
Compression Set @ 72°F	%	19%	18%
Compression Set @ 212°F	%	69%	58%
Bio-based content weight (Gen 1 biomass)	%	0%	40%
Cradle-to-gate Product Carbon Footprint (PCF)	kg CO ₂ e / kg product	3.10 kg	2.35 kg

Figure 2 Image courtesy of Avient Corporation

REGULATORY OVERVIEW:

Material of Construction

TPE (Thermoplastic elastomer)

Biocompatibility

USP <85>, Bacterial Endotoxin

USP <88>, Biological Reactivity Tests, Class VI, In Vivo

USP <87>, Biological Reactivity Tests, Class VI, In Vitro

ISO 10993-4, Hemolysis

ISO 10993-10, Irritation and Sensitization

ISO 10993-11, Systemic Toxicity

Physiochemical

USP <661>, Plastic Packaging Systems

Physiochemical (Continued)

EP 3.2.9, Rubber Closures for Containers

FDA 21 CFR 177.2600, Rubber Articles Intended for Repeated Use

Extractables

Per USP <665>

Legislation

REACH

RoHS

Conflict Mineral

Shelf Life

5 Years, Non-Sterile/Non-Irradiated

CONCLUSION:

Carolina Components Group® believes sustainability is a crucial issue for biopharmaceutical manufacturing. As stewards of innovation, we recognize the environmental impact of plastic resins in our industry. FlowLinX® overmolded TPE solutions are a great product to reduce the carbon footprint of your process.



We are committed to embracing sustainability without compromising the quality and safety of our next-generation components.

NOTES:

1. Bio-Based TPE for Biopharmaceutical Tubing Added to Avient's Sustainable Healthcare Solutions | Avient (<https://www.avient.com/news/bio-based-tpe-biopharmaceutical-tubing-added-avient-s-sustainable-healthcare-solutions>)
2. From first- to third-generation biofuels: Challenges of producing a commodity from a biomass of increasing complexity | Animal Frontiers | Oxford Academic (<https://academic.oup.com/af/article/3/2/6/4638639>)