**Bio-based foams for upholstery and mattresses**

# Sustainable Comfort

**Cushioning for upholstery, mattresses and vehicle seats is made primarily from petroleum-based polyurethane foams. Fraunhofer researchers are replacing the conventional material with sustainable foams made from renewable resources that provide exceptional comfort for seating and sleep systems.**

Manufacturers looking to include sustainable upholstery, mattresses and vehicle seats in their product lines will soon have an environmentally friendly alternative to the petroleum-based polyurethane (PU) foams currently used for these applications. In the OrganoFoam project, researchers at the Fraunhofer Institute for Structural Durability and System Reliability LBF have developed innovative PU foams that are made primarily from bio-based raw materials. The researcher's goal was to ensure continued uncompromising comfort, service life and product quality. The bio-based foams are designed for processing in existing industrial production equipment while providing the same level of comfort for sitting and lying down as conventional upholstery foams. The OrganoFoam materials were developed in close collaboration with Friedrich Platt GmbH, where they were evaluated and further processed. “We produce the bio-based PU foams in blocks in the laboratory. The foam blocks can vary in size, color and shape. Our project partner then cuts them to form products such as seat and back cushions for sofas,” says Roland Klein, a research scientist at Fraunhofer LBF in Darmstadt. The project was funded by the German Federal Ministry of Research, Technology and Space (BMFTR).

## Foam formulation needs no fibers for structural support

The researchers have succeeded in producing a sustainable flexible foam from bio-based polyols and bio-based isocyanates. “These two components are normally used to make coatings and are not actually suitable for flexible foams. However, by developing a specially tailored formulation, which we are having patented, we were still able to create our sustainable foams,” the researcher explains. “They are over 90 percent bio-based and contain only a few additives.” What sets the foam apart is that it does not require any natural fibers as a load-bearing support structure. Even without fibers, it exhibits the resilience typical of furniture for seating or lying down. In the foaming process, the material is expanded into blocks weighing up to eight kilograms. After demolding, it is mechanically crushed to open the cell structure, thereby ensuring dimensional stability. In other words, it retains its shape and size without warping, expanding substantially when heated or shrinking when cooled.

## Durable and comfortable

The foam blocks were used to build a demonstration sofa to test seating comfort and long-term durability under real-world conditions. Weathering tests with UV lamps showed that the bio-based foam yellows much more slowly than conventional upholstery foams and can be protected against UV radiation with suitable additives. "Conventional foams had already turned yellow and brittle after 100 hours, while our OrganoFoam shows hardly any discoloration even after 700 hours of UV exposure. That points to a long service life," says Klein. Compression hardness measurements and compression set tests confirmed that the sustainable foam, with its fine-pored, open-cell structure, can compete with the fossil-based reference foam. Tests at Friedrich Platt GmbH demonstrated that the supplied blocks can be readily cut using existing industrial equipment, bonded together to form larger sections and covered with standard upholstery fabrics. Participants praised the comfort of both sitting and lying down on the foam.

The bio-based foam is not only suitable for furniture and automotive applications but also as a replacement for petroleum-based materials in the packaging, construction and medical technology sectors. Potential uses include shock-absorbing packaging, sound insulation for walls and ceilings and medical positioning aids. For manufacturers committed to environmental protection and conservation of resources in their production processes, OrganoFoam provides an opportunity to reduce their carbon footprint and their use of fossil resources while appealing to environmentally conscious consumers.

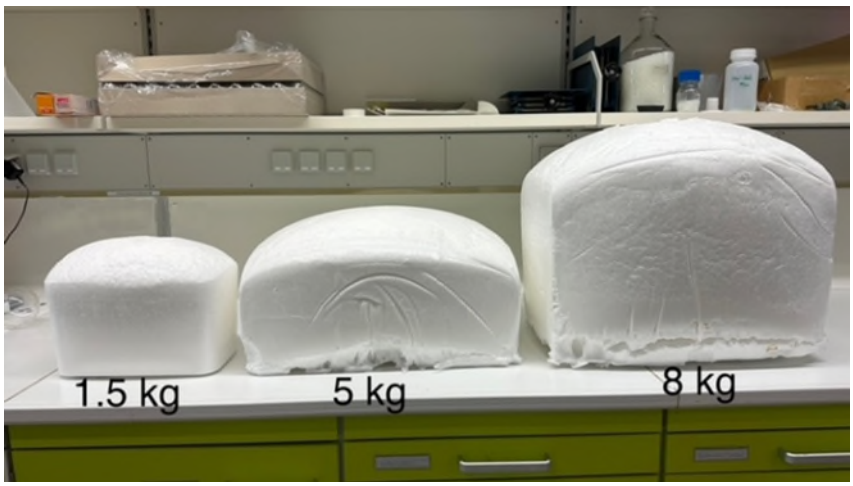



**Fig. 1 An OrganoFoam block before being cut into seat and back cushions for a pallet sofa**
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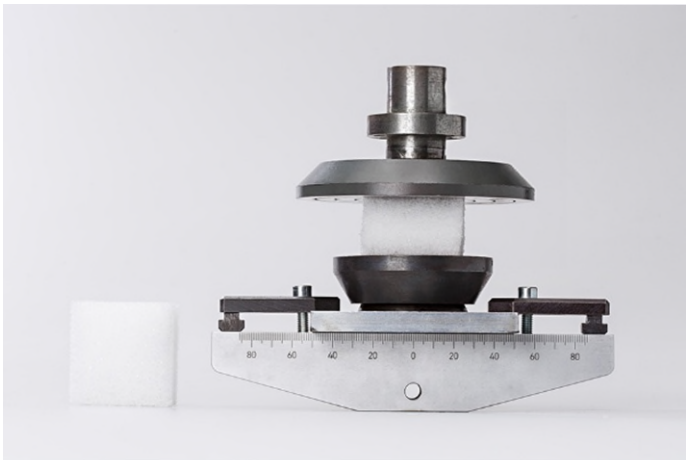


**Fig. 2 The new bio-based foams have a fine-pored, predominantly open-cell structure that meets the demands of use in upholstery and mattresses © Fraunhofer LBF**



**Fig. 3 Polyurethane foams made from renewable raw materials © Fraunhofer LBF**

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