

BIOTURF

Final Report

A sustainable, bio-based synthetic turf system with improved recyclability as an alternative for thousands of petroleum-based artificial turf pitches with microplastic infill currently due to be replaced in the European Union.

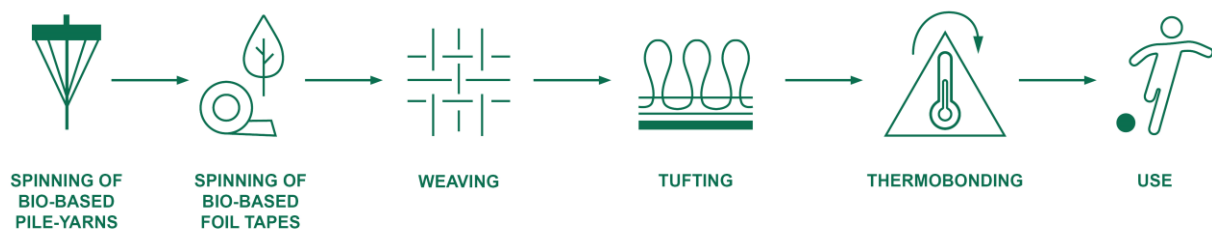


This year in summer, while the European Football Championships are taking place in Germany, the situation of many artificial sports pitches is looking rather critical. Currently artificial turf pitches are increasingly being built for new sports surfaces, especially in cities and urban centers instead of natural ones. Compared to natural turf, these offer an intensively usable, low-maintenance, weed-free and weather-independent surface that does not need to be watered or fertilized.

On the other hand, they are constructed of petroleum-based polyethylene fibers and equipped with microplastic infill material to ensure that the ball may roll and bounce just like on natural grass and allows the players to perform sliding movements on the artificial turf. The athlete's joy, the nature's sorrow: These microplastics are massively discharged from the artificial turf due to weather conditions such as rain or wind. Once released, they do not undergo biodegradation and, as such, may persist in the environment for hundreds of years as plastic pollution. Therefore, the EU is planning to ban the construction

of artificial turf pitches with micro-plastic infill material all across Europe in the next few years. The UEFA estimates that EU wide more than 25.000 artificial turfs need to be replaced in the upcoming years. The reason why an eco-sound and affordable replacement is urgently required and the BioTurf project comes into play.

The project researchers are working on a solution for an artificial turf structure made of bio-polyethylene (PE) like petroleum-based PE with a mono-material structure supposed to enable high-quality material recycling. Moreover, the innovative artificial turf structure will not require additional infill material, thus solving the current microplastic problem of artificial turf pitches.



The technical challenge

Technically, the main component of a traditional artificial turf is a three-dimensional textile, which is produced using the tufting process. Similar to sewing, yarns are needled into a textile web to form the "pile". On the reverse side of the tufting material, the pile yarns are bonded with the help of a latex suspension so that they cannot be pulled out during use. In addition, in a second coating step, another textile web is laminated with latex to improve the usage properties. When the tufting material is installed in the pitch, the pile is filled with sand and plastic granules in order to achieve the desired playing properties on the pitch. The multi-layer structure made of different materials makes it difficult to recycle after the pitch has been dismantled. The dismantling and disposal of used synthetic turf pitches is carried out by special providers. As the landfilling of used synthetic turf is prohibited in Germany, the plastic components are usually thermally recycled in waste incineration plants or landfilled abroad.

An innovative and holistic solution



The aim of this development is an innovative, 100% recyclable artificial turf made from a group of materials (polyolefins). The material used for the polyethylene pile yarns comes from rapeseed oil and agricultural waste that does not compete with food production. The backing that holds the pile yarn in place is made of polypropylene (PP) and is stabilized on the reverse side by a recycled film made from recycled old artificial turf pitches (lamination). The highlight of the newly developed artificial turf is a new process for fiber bonding. This new innovative process, known as thermobonding, replaces the

traditional back coating with latex, for example, which is very energy-intensive due to the drying process. The innovative thermobonding technology ensures that the final product is 100% recyclable at the end of its life. The increased use of bio-based and recycled materials together with the new, innovative production processes contribute to a significant reduction in the carbon footprint for synthetic turf. Based on a forecast production volume of 30 million m² of synthetic turf in 2025, the new BioTurf is expected to save 38,685 tons of CO₂.

Sustainability aspects

The use of a bio-based material for pile yarns and backing instead of fossil originated material has also been evaluated with regard to sustainability aspects. For BioTurf the ecological balancing, that we conducted with regard to the impact assessment, leads to the following, differentiated results: The processes for raw material production, transport, and manufacture (from the cradle to the factory gate) were observed and compared to a fossil-based benchmark product from Fieldturf Tarkett. Afterwards, we compared these data with 13 core indicators for environmental impacts in accordance with the recommendation of the BIOTEXFUTURE LCA guidelines.

In conclusion, we found great advantages using bio-based material with respect to the total global warming potential (GWP-total), potential for the depletion of abiotic resources for fossil resources and the consumption of non-renewable energy. On the other hand, we observed certain disadvantages on the potential eutrophication and acidification of the natural environment due to the possible harmful cultivation of the different bio-based raw materials (e.g. slash-and-burn farming for sugar cane cultivation, extremely high-water consumption for corn cultivation). Regarding a holistic bio-economic transformation, a precise consideration of all processes from cultivation, transport, further processing up to utilization must be considered.

Final project results

A real-life BioTurf soccer demonstration pitch is already installed in Aachen at the University Sports Centre, where athletes are already playing and training regularly and provide feedback as to the quality and the playability of the pitch.

With this real-life demonstrator the BioTurf team is presenting an innovative bio-based artificial turf without microplastic infill, which also offers the possibility of complete recyclability at the end of its life.



Contact and further information

TFI - Institute for Soil Systems at RWTH Aachen University

Dr. Claudia Post

Research Associate

Research Department, Team Materials & Utilization Properties/

Research, Materials and Use Behaviour

Phone: +49 (0) 241/ 9679-162

Email: c.post@tfi-aachen.de

Project partners:

TFI – Institute for Soil Systems at RWTH Aachen University

ITA – Institute of Textile Technology and Research of the RWTH Aachen University

Morton Extrusionstechnik GmbH, Abtsteinach, Hessen