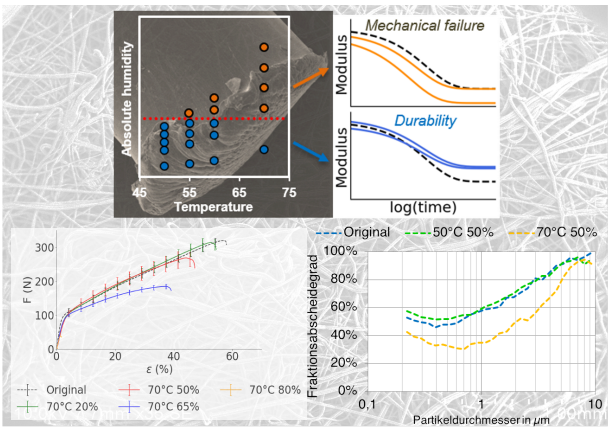
**BioFilter - Biogenic filter media based on thermoplastic polymers and fibers**

Nonwovens made of petroleum-based synthetic fibers, e.g. poly(etylene terephtalate) (PET) and polypropylene (PP) or glass fibers, are mainly used in air filtration. Bio-based and biodegradable PLA is considered as a perspective material to replace PET or PP in consumer goods and semi-finished products. However, PLA has specific properties, such as a relatively low glass transition and melting temperature, brittleness, slow crystallization behavior, and hydrolytic and thermal instability. As a result, there is a strong dependence of the resulting mechanical performance of the produced fibers towards the processing steps and climatic conditions. Currently, nonwovens made from PLA are mainly offered in the hygiene sector, which is dominated by disposable products with a short service life. However, the requirements for filter media differ significantly in terms of service life and conditions as well as structural and mechanical properties.

The project results show that the strong influence of the manufacturing parameters (e.g. temperature and degree of stretching) can be used to specifically control the properties of the staple fibers. A high degree of stretching made it possible to achieve high hydrolysis resistance despite the reduced molar mass of the polymer. The innovative core of the project was therefore to evaluate the possibilities and application limits of PLA nonwovens as filter media with sufficient mechanical properties, high deposition characteristics and long-term stability. From a materials science perspective, PLA offers a distinct advantage over PET in the electrostatic deposition mechanism simply because of its high negative surface charge, which could lead to products with improved performance.

The project results prove that the industrial use of bio-based nonwovens in the field of air filtration is possible under certain application conditions.




Technological risks in industrial production of PLA spunbonded nonwovens exist due to the fact that PLA is not a biobased drop-in chemical that can be immediately processed with the processes and infrastructures developed for its fossil analogues. Knowledge of the changes in properties due to process parameters will enable the transfer of expertise from research to an industrial scale. The use of PLA in the production of filter media represents a great opportunity for German textile companies as well as filter manufacturers to convert their product portfolios to biobased resources.

In a follow-up project, detailed statements on the dependence of the properties of biobased filter media under elevated temperature and humidity in long-term use are to be obtained. At the end of the project, this should enable the production of application-specific filter media for air filtration.

Relevant Publications and Internet-News:

1. Schippers, C.; Bahners, T.; Gutmann, J. S.; Tsarkova, L., Elaborating Mechanisms behind the Durability of Tough Polylactide Monofilaments under Elevated Temperature and Humidity Conditions. ACS Applied Polymer Materials 2021, 3, 1406-1414.https://doi.org/10.1021/acsapm.0c01274

2. Christina Schippers, Elena Marx, Ralf Taubner, Jochen Gutmann, Larisa Tsarkova. Evaluating the Potential of Polylactide Nonwovens as Bio-Based Media for Air Filtration. Textiles 2021, 1 , 268-282.https://doi.org/10.3390/textiles1020014

3. C. Schippers, R. Taubner, J. S. Gutmann, L. Tsarkova. Bewertung des Potenzials von PLA-Vliesstoffen als biogenes FiltermediumFiltrieren & Separieren 2021, N 03, 3-11.

4. Schippers, C.; Tsarkova, L.; Bahners, T.; Gutmann, J. S.; Cleve, E. Improved Maxwell Model Approach and its Applicability toward Lifetime Prediction of Biobased Viscoelastic Fibers. Macromol. Mater. Eng. 2021:2100443. https://onlinelibrary.wiley.com/doi/10.1002/mame.202100443

Zuse-Gemeinschaft:
https://www.zuse-gemeinschaft.de/presse/pressemitteilungen/luft-wasser-oel-was-pla-biokunststoff-gut-filtern-kann-und-was-nicht

**Project Information:**

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|---|---|
| Title (German): | Biogene Filtermedien auf Basis thermoplastischer Polymere und Fasern |
| Acronym: | BioFilter |
| Project number: | 19812 BG |
| Project duration: | 01.01.2018 - 31.12.2020 |
| Project Partner: | Sächsische Textilforschungsinstitut (STFI), Chemnitz |

Gefördert durch:
Bundesministerium für Wirtschaft und Klimaschutz
aufgrund eines Beschlusses des Deutschen Bundestages

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