

**BIOTEXFUTURE**

# **FURTHER APPLICATION AREAS FOR BIO-BASED TEXTILES**

**AUTOMOTIVE, HOME, & TECHNICAL TEXTILES, LAWN**

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# TRANSITIONLAB, TP C: THE TEAM OF THE BAYREUTH WORKSTREAM

A PROJECT WITHIN BIOTEXFUTURE



## TRANSITIONLAB → TP C (THE BAYREUTH WORKSTREAM)

**WHY?** Tackle the societal challenges for the transformation of the textile industry

**HOW?** Create knowledge about

- **success factors** as well as
- **ethical, legal and social implications (ELSI)** of this transformation

**Success factors of bio-based textile product innovations**

**Acceptance and communication of bio-based textile product innovations, communication guideline (work in progress)**

**Additional topic: Further application areas**



# CONTENTS OF THIS INSIGHTS SESSION

1 Introduction

2 Bio-based textiles in the automotive industry

3 Bio-based home textiles

4 Bio-based technical textiles

5 Bio-based lawn

6 Summary



# 1 INTRODUCTION

# INTRODUCTION

## FIBER PROCESSING AND TEXTILE PRODUCTION IN GERMANY

### Fibers processed, imported, and exported in Germany 2022

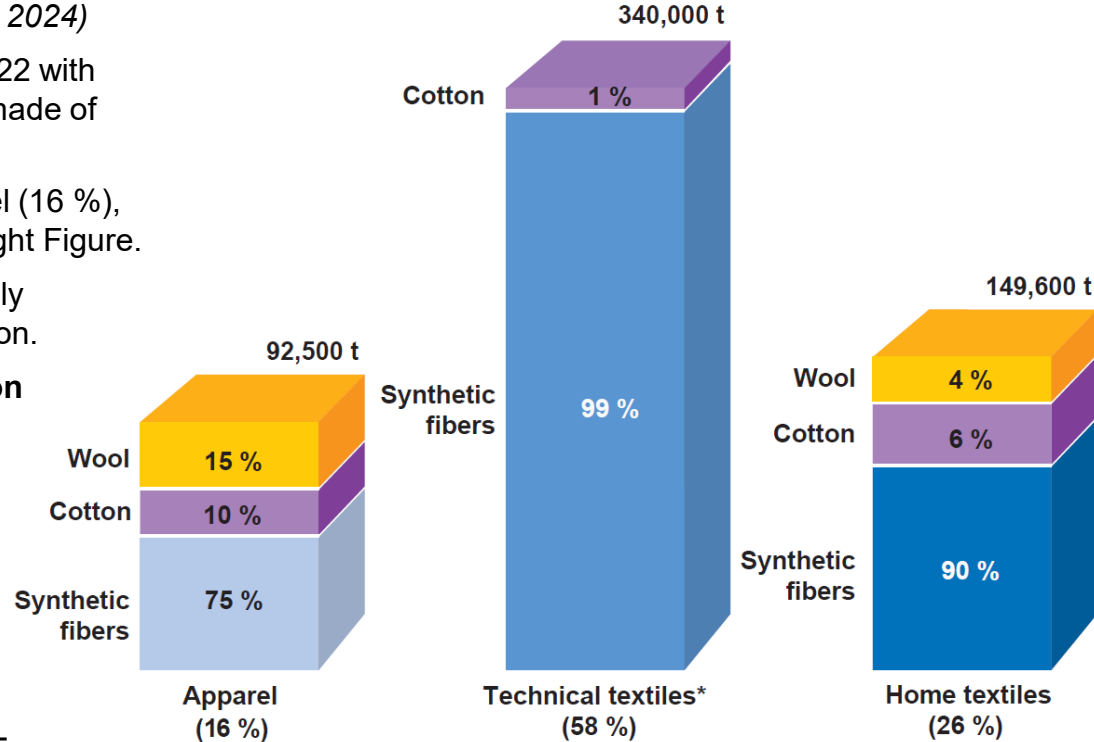
(Jahresbericht Industrievereinigung Chemiefaser e.V. 2024)

- Germany produced 357,000 t synthetic fibers in 2022 with a sales value of 1.5 bn. €, among them 148,000 t made of cellulose (Viskose, Modal, Cupro, Acetat, Lyocell).
- The total of 582,200 t fibers produced go to Apparel (16 %), Technical use (58 %), Home textiles (26 %), see right Figure.
- However, the German synthetic fiber production only reflects 0.57% of the global synthetic fiber production.

### Important German industry customers / application areas for apparel and textiles made in Germany

(Jahresbericht dt. Textil- & Modeindustrie 2023)

- Apparel and shoes industry: 2.773 bn. € in 2022,
- automotive industry: 1.435 bn. €,
- medical+health care industry: 1.149 bn. €,
- food industry: 361 mio. €,
- other German customers (public sector, retail, engineering, furniture, hospitality industry, ...): 6.420 bn. €

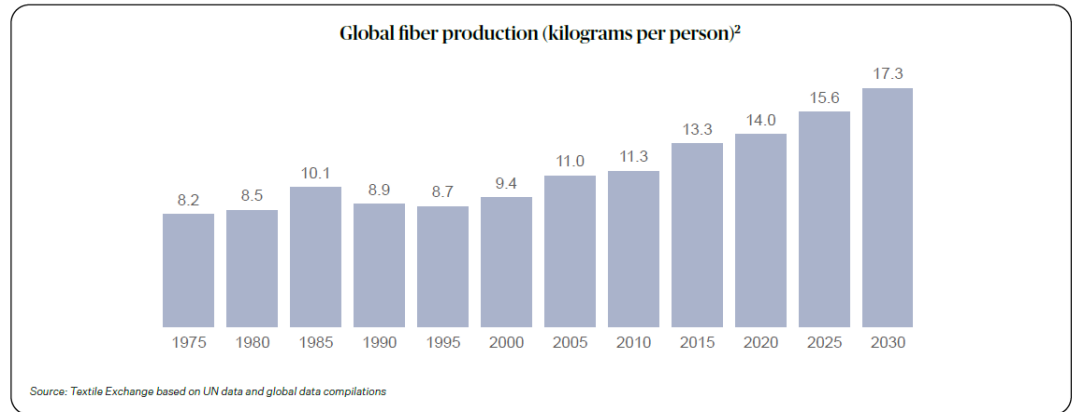
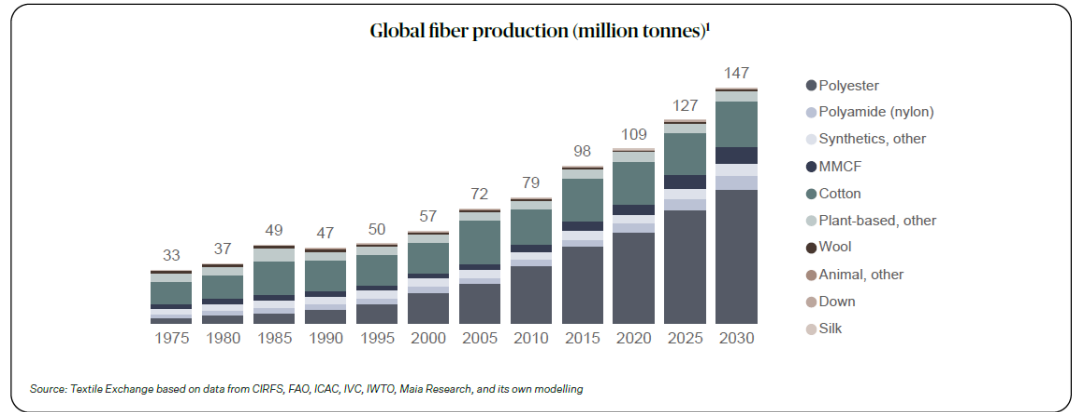


# INTRODUCTION

## GLOBAL FIBER PRODUCTION

### Global fiber production 1975 - 2030 (estimated) (Textile Exchange: Materials Market Report 2023)

- Global fiber production: 116 mio. t in 2022, expected to grow to 147 mio. t in 2030.
- Synthetic fibers: Polyester had a share of 54 % (63.3 mio. t), polyamids 5 % (6.2 mio. t), dominates cotton since the 1990s
  - Recycled polyester (99 % made from PET plastic bottles): 8.6 mio. t (13.6 %),
  - Bio-based polyester: ~10,000 t (0.01 %) according to the nova-Institute (2023)
  - Bio-based polyamid: ~20,000 t (0.02%)
  - Manmade cellulose fibers (Viscose): 6.3 % (7,5 mio. t)
- Plant-based fibers: Cotton 22 % (31.5 mio. t)
- Animal fibers (Wool, Down, Silk, ...): 1.6 % (1.9 mio. t)
- Global fiber per person increased, from 8.6 kg in 1975 to 14.6 kg per person in 2022.



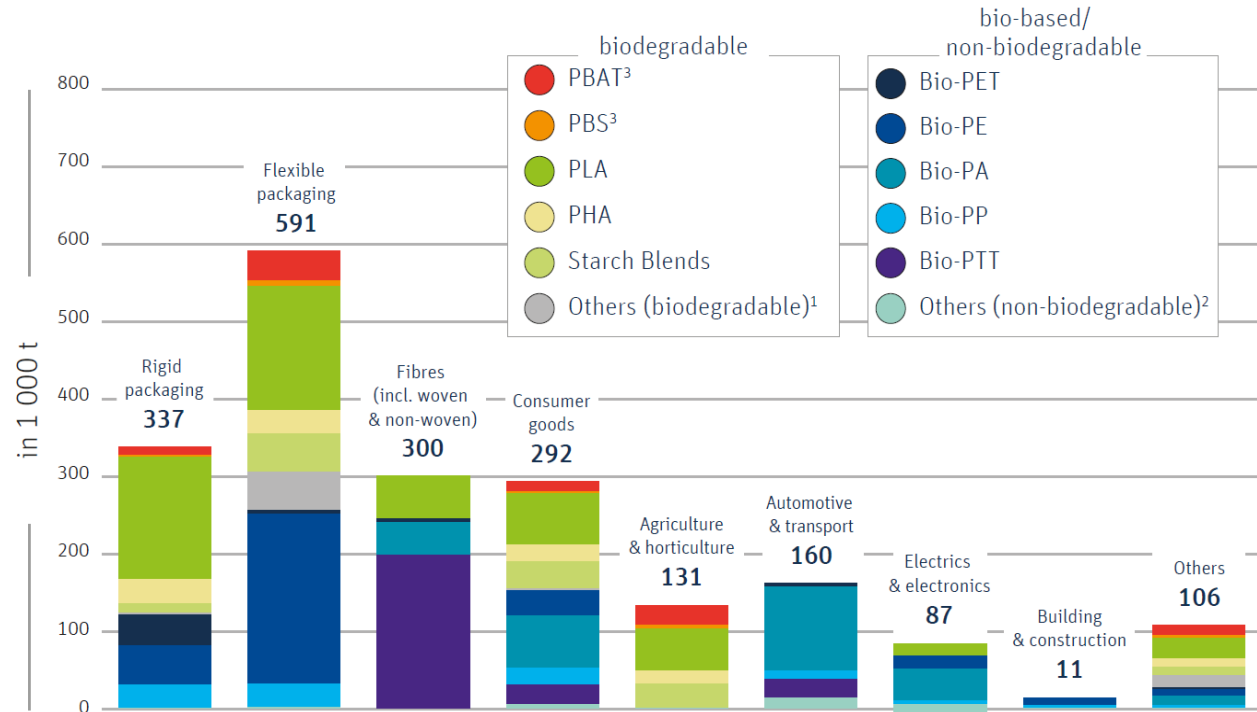
# INTRODUCTION

## GLOBAL BIO-PLASTICS PRODUCTION AS OF 2023

### Global bio-plastics production capacities by application area as of 2023

(Institute for Bio-plastics and Bio-composites, Hannover: Biopolymers Facts and Statistics 2023)

- Includes non-textile bioplastics applications (e.g., packaging, cases for smartphones, plant pots, signs, interior/exterior car components),
- estimated 2.015 mio. t in total



<sup>1</sup> Contains cellulose derivatives, PCL and regenerated cellulose.

<sup>2</sup> Contains Bio-PC, Bio-TPE, Bio-PUR (except thermosets).

<sup>3</sup> Only contains the share of bio-based or partly bio-based capacities.

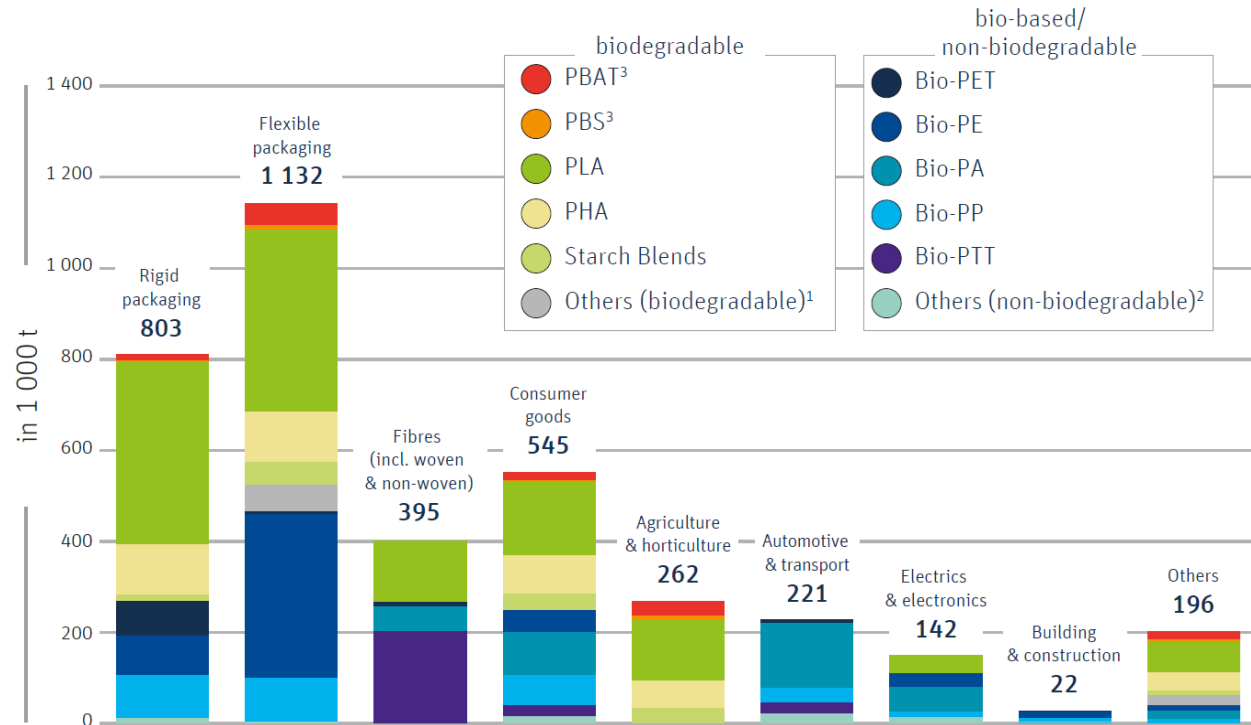
# INTRODUCTION

## GLOBAL BIO-PLASTICS PRODUCTION AS OF 2028 (ESTIMATED)

### Global bio-plastics production capacities by application area as of 2028 (estimated)

(Institute for Bioplastics and Biocomposites, Hannover: Biopolymers Facts and Statistics 2023)

- Includes non-textile bioplastics applications (e.g., packaging, cases for smartphones, plant pots, signs, interior/external car components),
- estimated 6.42 mio. t in total (+84.5 % increase versus 2023)



<sup>1</sup> Contains cellulose derivatives, PCL and regenerated cellulose.

<sup>2</sup> Contains Bio-PC, Bio-TPE, Bio-PUR (except thermosets).

<sup>3</sup> Only contains the share of bio-based or partly bio-based capacities.



# INTRODUCTION

## SAMPLE APPLICATIONS OF BIO-PLASTICS AND BIO-BASED TEXTILES

Application area	Automotive	Home textiles	Technical textiles	Lawn
<b>Sample applications</b>	Vegan leather, seat covers and other parts in the car interior made of rPET or bio-based, ...	(Bio-based) Towels (made of cotton, algae, banana, wood fibers), bed linen, sheets, ...	Tents, parachutes, plaster, firefighter suits, ...	Football fields, personal/landscaping lawns, ...
<b>Relevant stakeholders</b>	Government, car manufacturers, suppliers, car dealers, buyers of cars and accessories	Government, manufacturers, retailers (online and offline), buyers of home textiles	Government, various industries (e.g., chemical, automotive, ...), users (farmers, workers)	Football clubs, cities, players
<b>Expert interviews &amp; end user data collection</b>	Interviews with managers; three surveys (in total n=501 car, n= 308 child seat buyers)	retail stores (discount to luxury); survey (in total n=278 home textile buyers)	Interviews with managers of a world-leading tent company & a plastic tape manufacturer	Interviews with engineers, Institute Managers, Football club managers
<b>Results (see the following charts and discussions)</b>	End users are positive vs. bio-based, but other criteria dominate the buying decision; managers also, but they expect resource problems	End users are positive vs. bio-based, but other criteria dominate the buying decision; managers also, but they expect resource problems	End users are positive vs. bio-based, but other criteria dominate the buying decision; managers also, but they expect resource problems	End users are positive vs. bio-based, but other criteria dominate the buying decision; managers also, but they expect resource problems



## **2 BIO-BASED TEXTILES IN THE AUTOMOTIVE INDUSTRY**

# BIO-BASED TEXTILES IN THE AUTOMOTIVE INDUSTRY

## SAMPLE APPLICATIONS OF BIO-PLASTICS AND BIO-BASED TEXTILES

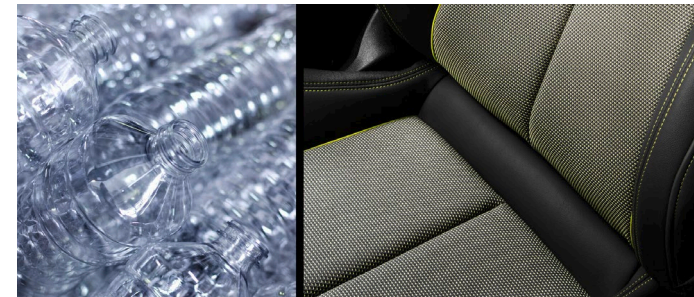
### Bio-plastics

- In the 1920s, Henry Ford constructed car prototypes with body parts made of hemp fibers and soy flour.
- “Coconut, wood, cotton - more and more renewable raw materials are being used in cars. Bio components were already used in the "old" Mercedes E-Class (W211) from 2002 to 2009.” (Auto Mobil Sport 2011, NTV 2012)
- Under the name "Biotech Material", Mazda has also been an early adopter (since 2012) of plant-based bio-materials that help reduce the use of petroleum-based materials and reduce CO<sub>2</sub> emissions. The housing of the center tunnel, parts of the interior trim and the glove compartment flap are made of the new material.



### Bio-based textiles and textiles made of recycled PET bottles

- In the fourth generation of the Audi A3 (from 2020), up to 89% of the textiles are made from recycled PET bottles: (parts of) seat covers, insulation materials, side panels, and loading floors, insert mats.
- Cybex offers child seat covers for cars made from recycled PET.
- Magna develops seat covers made from organic and reusable materials. The Bentley EXP 100 GT has vegan leather seats (made of wine pomace).



# BIO-BASED TEXTILES IN THE AUTOMOTIVE INDUSTRY

## STUDY 1: SUSTAINABLE SEAT COVERS (RECYCLED PET, BIO-BASED)

### Research questions

- How important are sustainability aspects when buying a car, especially when it comes to interior design?
- Which features are must-be (M), one-dimensional (O), attractive (A), indifferent (I) from a car buyers point of view?

### Preliminary study

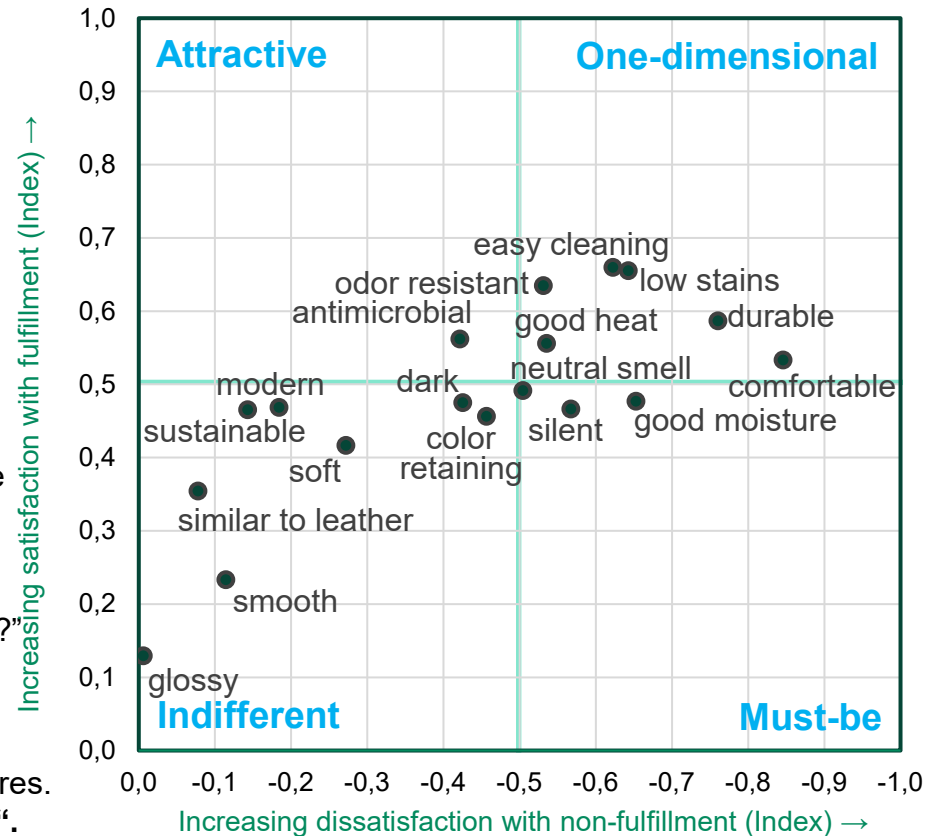
- 15 min. interviews with n=6 interior experts in the automotive industry (Magna, Daimler, Hyundai, Porsche) 12/2023
- Development of a list of 14 important features a seat cover should have: easy cleaning, smooth, silent, comfortable, ...
- Experts' top-3 assumption: durable, comfortable, soft
- Experts' bottom-3 a.: color retaining, antimicrobial, sustainable

### Survey

- n=242 car buyers answered a Kano survey: "How would you feel if the seat cover has this feature?" / "... has not this feature?"

### Results

- Comfortable, durable, low stains, easy cleaning, odor resistant, good heat, neutral smell are most important features.
- Sustainable (operationalized via a label) is just „nice-to-have“.



# BIO-BASED TEXTILES IN THE AUTOMOTIVE INDUSTRY

## STUDY 2: SUSTAINABLE CHILDREN SEATS FOR CARS



### Research questions

- How important are sustainability aspects when buying a children seat for a car?
- Which features are must-be (M), one-dimensional (O), attractive (A), indifferent (I) from a car buyers point of view?

### Preliminary study

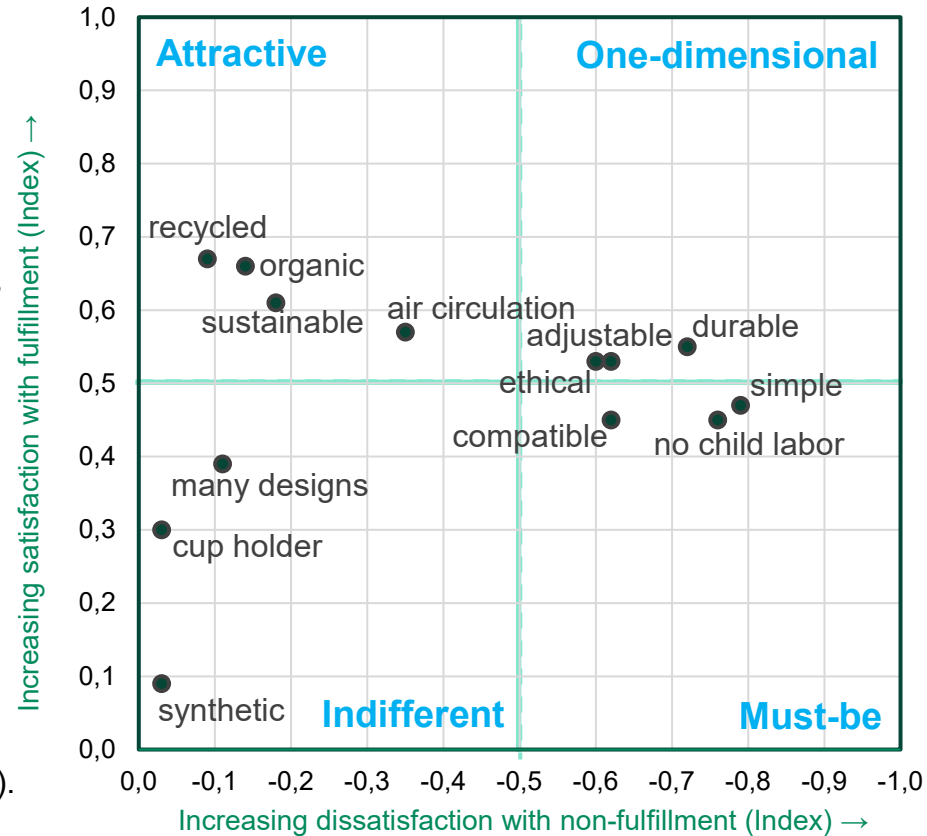
- 15 min. interviews with n=10 seat cover buyers and experts from the children seat industry (cybex) 09/2023
- Development of a list of 13 important features a children seat cover should have: simple, durable, air circulation, ...

### Study

- n=308 children seat for cars buyers answered a Kano survey: "How would you feel if the children seat for cars has this feature?" / "... has not this feature?"

### Results

- Durable, adjustable, ethical are important (one-dimensional), simple, compatible no child labor even necessary (must-be).
- Sustainable (operationalized by a label) is interesting (attractive).
- Higher prices are only accepted by the rich.



# BIO-BASED TEXTILES IN THE AUTOMOTIVE INDUSTRY

## STUDY 3: SUSTAINABLE CAR INTERIORS, ESPECIALLY POMACE-BASED SEAT COVERS (VEGAN LEATHER)

### Research questions

- How important are sustainability aspects when buying a car, especially when it comes to interior design?
- Is **vegan / artificial leather** (seat covers made from pomace) an alternative to traditional leather?

### Preliminary study

- Interviews with n=13 car buyers and n=7 sales persons
  - Importance of sustainability when buying cars, especially when selecting car interiors
  - Attitude and purchase intention related to buying sustainable seat covers, e.g., made from pomace
- **Secondary research** (articles, studies, websites)

### Results


- **Sustainability and interior design is of little importance**
- Top-3 important attributes when buying a new car
  - Price-value (92 % mentionings)
  - Durability (72 %)
  - Technical equipment (53 %)
  - **Sustainability (47 %)**
  - **Interior design (24 %)**




VW ROOMZZ: seat covers made from apple pomace




Bentley EXP 100 GT with seat covers made from wine pomace

As long as vegan leather is not required, no manufacturer will rush into making it 

Sustainability will only play a role if people are forced to do so. 

Customers who think about sustainability can afford to think about it. 

A few people might be happy, but it is not a purchasing motive. 

# BIO-BASED TEXTILES IN THE AUTOMOTIVE INDUSTRY

## STUDY 3: SUSTAINABLE CAR INTERIORS, ESPECIALLY POMACE MADE SEAT COVERS (VEGAN LEATHER)

### Survey (distributed online and personally at car dealers)

- n=149 car buyers (30 to 69 years), n=97 students
- Past behavior, attitudes, and sustainable buying intentions

Wie bereits erwähnt, möchten wir das **Nutzungsverhalten von veganem Leder** in der Automobilindustrie untersuchen. Dabei legen wir besonders den Fokus auf Leder, welches aus Trester hergestellt wird.

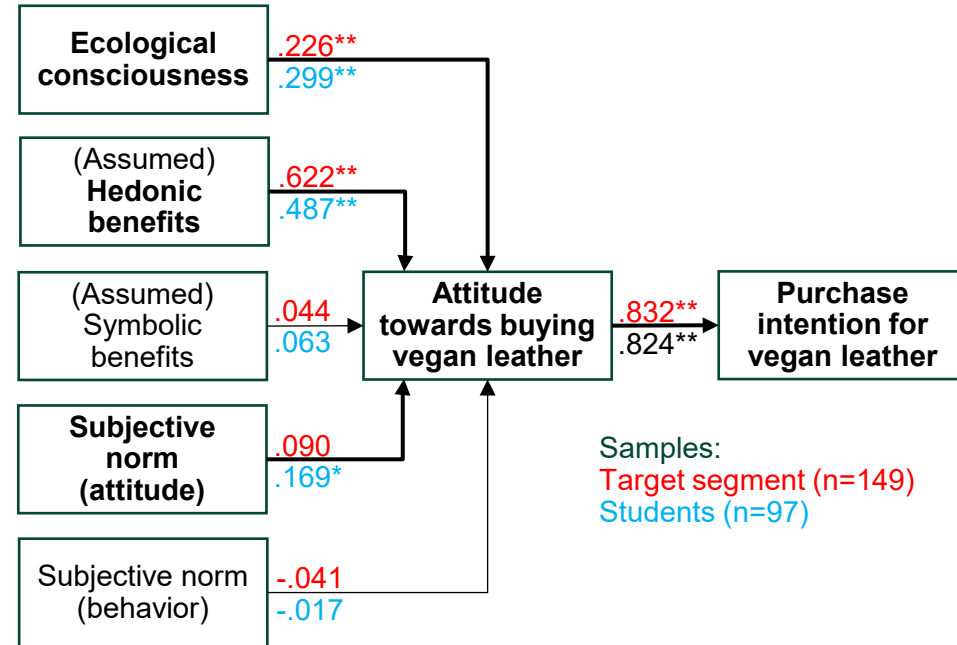
Trester ist das Abfallprodukt (Kerne, Traubenreste), welches bei der Weinproduktion übrig bleibt. Daraus kann in einem innovativen Verfahren ein nachhaltiges und pflanzenbasiertes Leder hergestellt werden. Das vegane Endprodukt besteht damit zu 70% aus nachwachsenden und recycelten Rohstoffen. Außerdem sieht das Produkt aus und fühlt sich an wie echtes Leder. Es ist zudem **langlebig, frei von Lösungsmitteln und tierfreundlich**.

Im Folgenden wird Ihnen beispielhaft die pflanzenbasierte Inneneinrichtung eines Autos von Tesla gezeigt:



### Results

- **Purchase intention** is mainly driven by **hedonic benefits** (ability to generate happiness and satisfaction) and by **ecological consciousness** (attitude towards sustainability)
- Sustainability is somewhat important for a few buyers (29 %), but no sustainability information was made available to them.



Samples:  
 Target segment (n=149)  
 Students (n=97)

\*: significant at the .05 level, \*\*: ... at the .01 level

# BIO-BASED TEXTILES IN THE AUTOMOTIVE INDUSTRY

INTERVIEW WITH DR. MIKE HERBIG, AUDI AG

## Expert interview

- Dr. Mike Herbig is the Head of Exterior Pre-Development at Audi AG, Ingolstadt. He heads the polymer team at Audi AG and is responsible for the collaboration with VW and research institutions on the topic.
- **Objectives at Audi concerning sustainability in polymer usage**
  - Cycles should become an integral part of the value chain. Projects examine how physical, mechanical and chemical recycling can be used for this purpose. Needed are high-quality granulate for series use.
  - In collaboration with VW, standards are being created that specify the requirements for granules (standard 50026). Extensive and good experience has already been gained with PET bottles as a basis for paints, fibers, artificial leather (= vegan leather, but a less confusing term), and seat covers.
- **Challenges**
  - The provision of the necessary raw materials for recycling (a car needs 220-300 kg of plastics, Audi produces 2 Mio. Cars per year) in sufficient quality. The key requirements are longevity and associated high quality and repairability.
  - Regarding bio-based plastics: Interesting resource, but: scarcity is probably a problem (competition with agriculture, water consumption during production), can only be used as an additive (cf. biofuels).
- **Recommendations for the Automotive Application Area**
  - You have to think in circularity from the start (design for circularity), even if cycles for cars are very long (10-15 to 50-60 years). The ability to repair plays a key role here. If customers are still hesitant, you have to rely on arguments such as longevity, robustness, updateability/repairability (USPs of German car manufacturers) - unlike with consumer goods. Especially because the resale value is key for many buyers.
- **Summary**
  - Adidas and Audi would be an excellent cross-industry option: designing textiles in such a way that they could be reintroduced into the cycle. At Audi and Adidas however, they are very cautious about suspected greenwashing.





# **3 BIO-BASED HOME TEXTILES**

# BIO-BASED HOME TEXTILES

## SAMPLE APPLICATIONS



<https://doctortowels.com/products/banana-terry-face-towels-pack-of-2>



<https://www.kushel.de/en/pages/kushel-handtuch>

In addition to the most commonly sought-after fabrics of natural origin such as cotton or linen, there are now also bio-based home textiles (e.g. bed linen, sheets, towels) made from other fibers on the market, such as birch wood, banana plant, eucalyptus, bamboo, corn or kapok.

The currently best-known bio-based fibers in the home textiles sector include Lyocell, Tencel, Ingeo and Modal.



<https://www.tencel.com/b2b/trademark-protection>



<https://www.lampertsmuehle.de/lenzing-modal/>

# BIO-BASED HOME TEXTILES

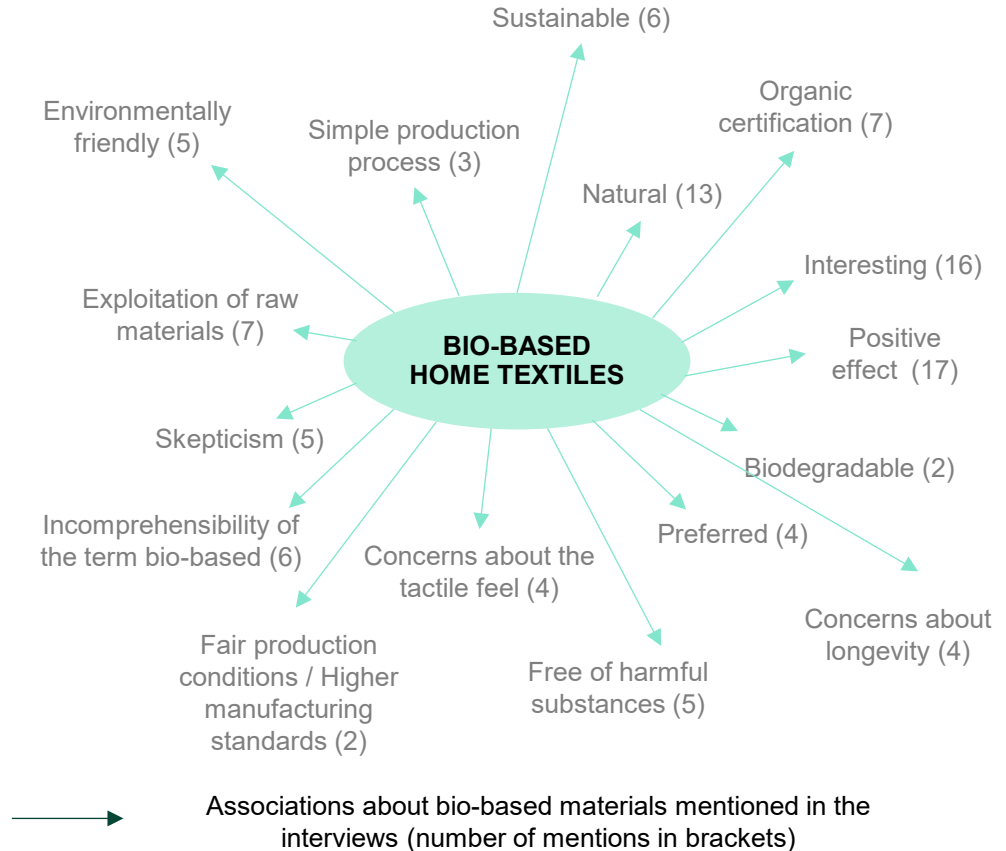
STUDY: (BIO-BASED) TOWEL (COTTON, ALGAE, BANANA & WOOD FIBERS)

## Research questions

- When buying a towel, how important are various attributes such as for example the material, the proportion of bio-based materials in the fabric or the price?
- Are consumers willing to pay a surcharge for certain sustainability-related aspects (e.g. bio-based materials, labels, etc.) and if so, how much?
- Which characteristics of the various attributes are preferred?

## Pretest

- Interviews with n=10 regular towel buyers concerning important attributes when buying towels with a focus on attributes regarding sustainability (especially material)
- Extraction of the relevant attributes for towel purchases in this regard (taking into account existing literature)
- Additional identification of associations and concerns about bio-based materials



# BIO-BASED HOME TEXTILES

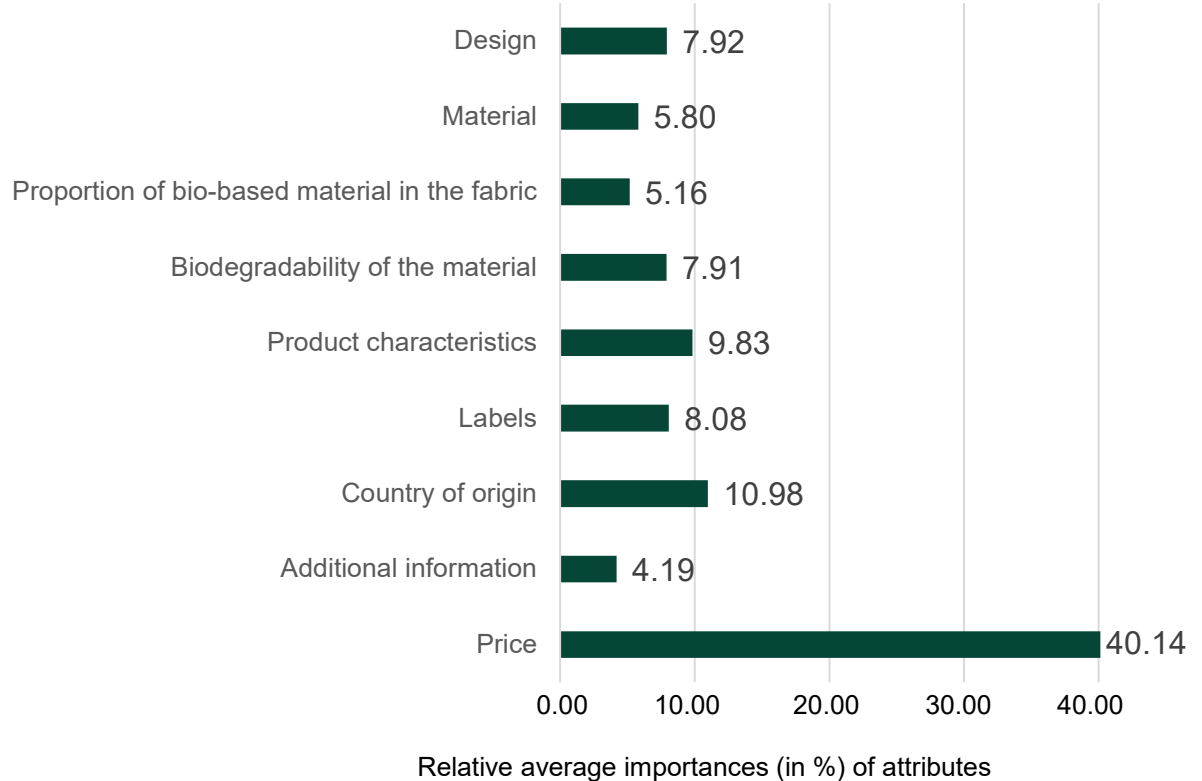
STUDY: (BIO-BASED) TOWEL (COTTON, ALGAE, BANANA & WOOD FIBERS)

## Study

- n=268 consumers with experience in buying towels (from 18 to 42 years)
- Adaptive Choice-Based Conjoint analysis utilizing the 'summed price' approach

## Results (1/2)

- Most important attribute when buying towels is price
- Material and proportion of bio-based material in the fabric are less relevant in relation
- Most frequent **must-have** feature:
  - Made in Europe (20.52%)
- Most frequent **unacceptable** features:
  - Made in Asia (20.52%)
  - Blue towel with pattern (12.69%)
  - No label (11.19%)
  - Not biodegradable (10.82%)
  - 0% bio-based material (8.96%)



# BIO-BASED HOME TEXTILES

## STUDY: (BIO-BASED) TOWEL (COTTON, ALGAE, BANANA & WOOD FIBERS)

Attribute	Level	Average Utility	SD
<b>Design</b>	Gray towel without pattern	24.57	34.96
	Gray towel with pattern	-3.04	18.10
	Blue towel without pattern	-0.57	25.59
	Blue towel with pattern	-20.96	29.01
<b>Material</b>	Cotton fibers	-26.68	23.21
	Algae fibers	11.96	15.99
	Banana fibers	4.47	15.14
	Wood fibers	10.25	14.82
<b>Proportion of bio-based material in the fabric</b>	0% bio-based material	7.67	22.69
	20% bio-based material	-6.60	16.38
	50% bio-based material	-8.03	14.66
	100% bio-based material	6.96	21.09
<b>Biodegradability of the material</b>	Not biodegradable	-26.64	43.52
	Biodegradable in more than 6 months	18.17	22.71
	Biodegradable in less than 6 months	8.47	29.02
<b>Product characteristic</b>	Absorbent	-33.63	34.71
	Absorbent and soft	20.54	34.97
	Absorbent and colorfast	-16.34	22.37
	Absorbent, colorfast and soft	29.43	38.57
<b>Additional information</b>	No additional information	-5.37	18.83
	Additional information on the production of the material	-2.44	13.56
	Additional information on the cultivation and extraction of the raw material	6.49	14.97
	Additional information on the fiber	1.31	15.63
<b>Labels</b>	No label	-25.43	38.23
	Eco label	7.18	16.47
	Social label	-8.77	10.57
	Eco and social label	27.02	29.06
<b>Country of origin</b>	Made in Asia	-57.84	44.13
	Made in Europe	31.31	21.75
	Made in Germany	26.53	26.31
<b>Preis</b>	6.30 €	180.62	86.56
	39.66 €	-180.62	86.56
<b>None-Option</b>	Derived through screening section	117.54	45.24
	Derived through calibration section	107.38	104.04

## Results (2/2)

- Relative surcharges (selection):

	Relative surcharge
Algae fibers on cotton fibers	3.57€
Banana fibers on cotton fibers	2.88€
Wood fibers on cotton fibers	3.41€
20% bio-based material on 0%	-1.32€
50% bio-based material on 0%	-1.45€
100% bio-based material on 0%	1.35€
Biodegradable in more than 6 months to not biodegradable	4.14€
Eco label on no label	3.01€
Social label on no label	1.54€
Eco & social label on no label	4.84€
Made in Europe on Made in Asia	8.23€
Made in Germany on Made in Asia	7.79€

- Consumers are willing to pay a surcharge for bio-based materials from algae (3.57€), wood (3.42€) and banana (2.88€) compared to cotton
- Consumers are only willing to pay a surcharge for 100% bio-based material (not for 20% or 50%)
- Eco labels are more important compared to social labels
- Country of origin is very important (Made in Europe is sufficient)

Averaged part-worth utilities (zero-centered diffs) of the attribute levels

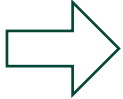
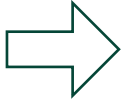

# BIO-BASED HOME TEXTILES

## INTERVIEWS WITH HOME TEXTILE STORES ABOUT BIO-BASED PRODUCT RANGE AND EXPERIENCES

### Study

- n=6 home textile stores in different price segments (discount to luxury)

### Research questions

- What materials are the home textiles on offer mainly made of and is there a range of bio-based home textiles in local stores? 
- Which bio-based materials can be found in the product assortment of home textile stores? 
- Is there a demand for bio-based home textiles in local stores? 

### Results

- Many home textiles are made from inherently natural fibers such as linen, cotton, hemp or silk
- Scarcity of raw substances for bio-based materials and the resulting low supply of corresponding fabrics for sale is probably a problem, therefore very limited range of home textiles made from bio-based materials (no range at all in the discount segment)
- Materials made from wood fibers, e.g. Lyocell, Tencel, Modal (mostly from eucalyptus, spruce, pine, birch and beech), Ingeo (made from corn fiber), Kapok (mostly as an additional material)
- Generally lower demand → Higher demand for alternative bio-based home textiles in specialist stores, customers are looking for material without synthetic processing (e.g. if they are allergic to polyester, due to sustainability or the certain knowledge of good manufacturing conditions)
- Alternative bio-based fabrics are often unknown & many people think of synthetic fibers when they hear technical-sounding names → Therefore sales advice and clear explanations are necessary and extremely important

# **4 BIO-BASED TECHNICAL TEXTILES**

# BIO-BASED TEXTILES IN THE TECHNICAL TEXTILES INDUSTRY

## SAMPLE APPLICATIONS

### Technical Textiles

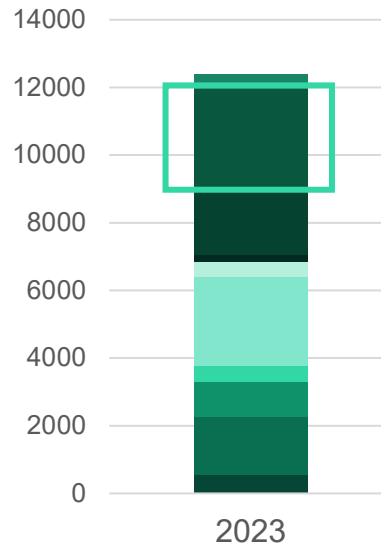
= Category of textiles specifically engineered and manufactured to **serve functional purposes** beyond traditional apparel and home furnishing applications (e.g., protective suits, tents → flame retardant)



### Importance

- Total sales (2023): ~ **3 billion Euros**
- Sales in Germany (2023) based on segments in million Euros:

- Spun textiles
- Refinement of textiles
- Tailored textiles (expt. clothing)
- Ropes and cords
- TECHNICAL TEXTILES
- Weaving mills
- Knitted fabric
- Carpets
- Fleece
- Others



Source: Statistisches Bundesamt (2023)

### Industries and sample applications

- Agrotech (e.g., coverings against insects)
- Buildtech (e.g., sarking membrane)
- Clothtech (e.g., wind- and water-proof components)
- Medtech (e.g., bandaging material)
- Sporttech (e.g., parachutes)
- ... and many more



# BIO-BASED TEXTILES IN THE TECHNICAL TEXTILES INDUSTRY

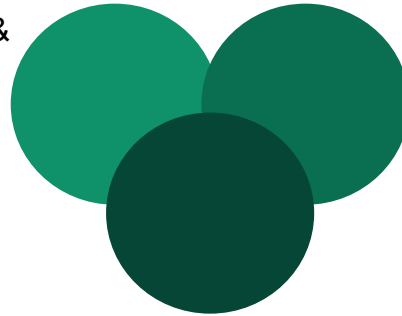
INTERVIEWS WITH RESPONSIBLE MANAGERS AND RESEARCHERS

BIOTEXFUTURE

Expert interviews (n=3)

CEO  
investigating &  
producing  
**UD tapes**

CEO  
world-leading  
**tent company**



Scientific researcher  
on **bio-based  
tapes**



## Results

- Role of **bio-based** materials differs between **product categories**

Almost no role for **tents** (composition & decomposition of tents already sustainable), only for floor systems.

Several customers ask for bio-based **plastic solutions**, especially in high-price segments (for **sport and leisure** products) → Dyneema fibres but: 10 times **more expensive**

- Role of **recycled** materials (with more regulatory requirements)
  - Increasing demand (might need 8 more years)
  - No willingness to pay more

- For bio-based plastics/fibre-reinforced tapes:
  - Substitution of conventional raw materials
  - Various application areas, such as cars' chassis
  - However: Not part of the mass market yet
  - More expensive compared to conventional fibres (e.g., flax fibres vs. glass fibres)



## Outlook

- For plastic solutions
  - Increasing demand (especially in research)
  - Declining prices
  - Lack of high quantity will resolve over time

## **5 BIO-BASED LAWN**

## BIO-BASED LAWN

### SAMPLE APPLICATIONS

With the recent EU-ban on microplastics, artificial lawns can no longer use microplastic infills after 2031 (BMUV, 2023). Public funding for plastic infill in Germany stopped in 2019 (SWR, 2023)



Mix of olive pits and cork as bio-based alternatives for lawn infills.



Mix of plastic filaments with bio-based and degradable infill.

## BIO-BASED LAWN

INTERVIEWS WITH DENNIS FRANK, ISP, AND DR. ULRICH BERGHAUS, IAKS

**Mr. Dennis Frank** is the institute manager of ISP (Institut für Sportstättenprüfung) GmbH, Germany, and has hands-on experience with a variety of turf projects.

The ISP works closely with turf manufacturers throughout complete project timelines in terms of certification, quality control, maintenance, etc.

### Insights at ISP

- ❑ The main decision driver for new turf projects will likely always be cost.
- ❑ Players are neither involved, nor notice a difference in the type of artificial turfs they play on.
- ❑ Despite a grace period until 2031 there have been no new turf installations with synthetic infills in the last 3-4 years, due to a lack of funding. Organic infills (cork, olive pits, corn) exist but may lead to other issues.
- ❑ The industry should not focus too heavily on food derived bio-plastics (e.g. sugar cane).

In collaboration with various turf manufacturers the ISP conducts the qualifying examination of various turf concepts according to DIN norms. Experiences have been collected with prior industry partners using bio-based artificial turfs. While the technical properties are on par with the conventional plastic-based turfs, prices are usually higher.



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**Dr. Ulrich Berghaus** is a board member of the IAKS Germany, a board member of Biotexfuture and an expert in the field of extrusion technology & bio-based turfs.

### Insights from Dr. Berghaus

- ❑ Although price is the main driving point: expensive, yet sustainable and circularity focused projects, may still be favored. As the call for bids now increasingly these aspects. Similarly, funding now, more than ever, also considers factors beyond the price.
- ❑ Established players (like Tecnar) are working on bio-based infill materials that follow the ECHA requirements.
- ❑ Not all food-sourced solutions put a strain on agriculture: food-sourced infills (olive pits, corn cores) leverage food waste with no further application area. Recent years
- ❑ While prices are generally higher, these are likely to decrease substantially as processes mature, and production scale increases.

Despite advances in recycling capabilities and bio-based approaches, current quantities cannot satisfy the resource-demand.



## Regarding food-sourced materials: good alternative from current market leaders like Polytan, but:

- ❑ Viability depends on the application: bio-polymers from sugar cane may undermine sustainability goals (IAKS – Schimmelpfennig 2022); food-sourced infills like olive pits on the other hand are promising because they have no downstream potential.
- ❑ Some have substantive negative properties and require long-term evaluation (e.g. cork).

## Recommendations for the Lawn Application Area

- ❑ Similar to automotive: circularity can be one of the strongest selling points.
- ❑ Although current bio-turfs will not enter circulation for 10 years, planning to reintroduce existing materials into the value creation is paramount. Recycling efforts should aim at using a diverse spectrum of polymers (both bio and fossil).
- ❑ Circular projects can potentially garner more funding than non-circular ones.
- ❑ Using organic infills is a viable stopgap until ECHA compliant bio-based infills are available.

## Summary

- ❑ Cost concerns are likely temporary, as they will naturally decrease as processes mature, and operations scale up.
- ❑ Current approaches to bio-based turfs already fulfill all technical requirements and players do not notice a difference.

## **6 SUMMARY**

Application area	Automotive	Home textiles	Technical textiles	Lawn
<b>Sample applications</b>	Vegan leather, seat covers and other parts in the car interior made of rPET or bio-based, ...	(Bio-based) Towels (made of cotton, algae, banana, wood fibers), bed linen, sheets, ...	Tents, parachutes, plaster, firefighter suits, ...	Football fields, personal/landscaping lawns, ...
<b>Relevant stakeholders</b>	Government, car manufacturers, suppliers, car dealers, buyers of cars and accessories	Government, manufacturers, retailers (online and offline), buyers of home textiles	Government, various industries (e.g., chemical, automotive, ...), users (farmers, workers)	Football clubs, cities, players
<b>Expert interviews &amp; end user data collection</b>	Interviews with managers; three surveys (in total n=501 car, n= 308 child seat buyers)	retail stores (discount to luxury); survey (in total n=278 home textile buyers)	Interviews with managers of a world-leading tent company & a plastic tape manufacturer	Interviews with engineers, Institute Managers, Football club managers
<b>Results</b>	End users are positive vs. bio-based, but other criteria dominate the buying decision; managers also, but they expect resource problems	End users are positive vs. bio-based, but other criteria dominate the buying decision; managers also, but they expect resource problems	End users are positive vs. bio-based, but other criteria dominate the buying decision; managers also, but they expect resource problems	End users are positive vs. bio-based, but other criteria dominate the buying decision; managers also, but they expect resource problems



**THANK YOU FOR YOUR ATTENTION!**

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