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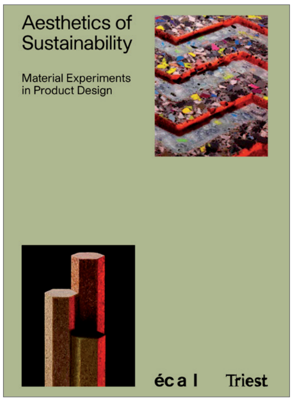


Thilo Alex Brunner (Hrsg.)
**Aesthetics of Sustainability.**
**Material Experiments in Product Design**

Buchgestaltung: Federico Barbon

Englisch, 272 Seiten, ca. 150 Abbildungen
19 × 26 cm, Klappenbroschur

Euro (D) 39–, Euro (A) 40.–, CHF 39.–
ISBN 978-3-03863-062-3

**Mit Beiträgen von** Christophe Guberan, Chris Lefteri, Ala Tannir und Absolvierenden des ECAL-Studiengangs MA Product Design.

Neuerscheinung Februar 2021

# Nachhaltige Materialien entwickeln

- **Auf ressourcenschonendem Papier aus Algen und Kiwi-Schalen gedruckt**
- **Neue, nachhaltige Materialien für Produktdesign**
- **Wissensvermittlung, wie neue Materialien erprobt und angewendet werden**

Dieses Buch fasst die Ergebnisse des Forschungsprojekts «The Aesthetics of Sustainability» an der ECAL zusammen. Es vereinte Masterstudierende im Bereich Produktdesign, etablierte Materialspezialisten, Hersteller und Forscherinnen mit dem Ziel, das ästhetische Potenzial einer neuen Generation nachhaltiger Materialien zu erforschen und zu definieren.

Das Ergebnis dieses Forschung-durch-Design-Projekts sind vierzehn Fallstudien. Entwickelt wurden Materialien aus pflanzlichen Fasern wie Algen, Reisspelzen, Hanf, Flachs oder Holz, aus Textilabfällen, Recyclingpapier oder Gummigranulat. Daraus entstanden neue Werkstoffe, die sich formen, pressen, weben oder schweissen lassen. Eine Auswahl dieser Materialien wird mittels Experimenten und Prototypen von Produkten präsentiert.

Ziel ist es, zukünftigen Designerinnen und Produktgestaltern eine Reihe von praktischen Werkzeugen und angewandtes Wissen über die Methoden zur Analyse und Verarbeitung von wegweisenden Materialien anzubieten, wie am besten mit ihren Qualitäten umgegangen werden kann und wie daraus funktionale und dennoch ästhetisch faszinierende Objekte entwickelt werden können.

Diese neuen Materialien sollen auch den Nachweis erbringen, dass ökologisch hergestellte Produkte sowohl aus Hersteller- als auch aus Verbrauchersicht sinnvoll sind und sich auf dem Markt etablieren können.

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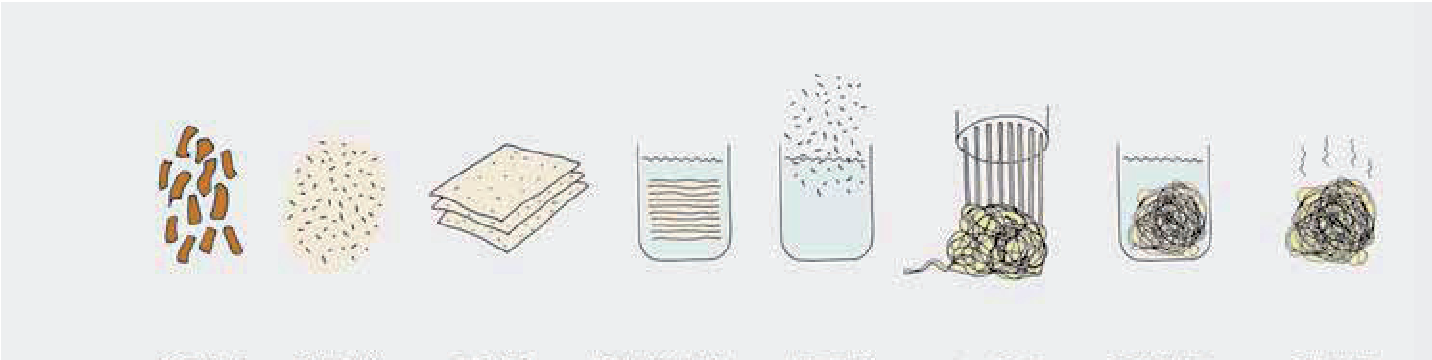

# Über den Herausgeber

**Thilo Alex Brunner** ist ein in Zürich ansässiger Schweizer Produktdesigner und Mitbegründer mehrerer Designbüros. Er war zehn Jahre lang Dozent an der ECAL / Universität für Kunst und Design in Lausanne und leitete bis 2018 den MA in Produktdesign.

*SeaCell™*

ⓐ ①

Seaweed before being dried and powdered to be permanently embedded into cellulose fibres.

Introduction

SeaCell™ is a fibre made from beech tree—or eucalyptus—cellulose and organic seaweed produced in Austria using the Lyocell process: an innovative and eco-friendly production method that brings solid materials into a cellulosic fibre. The dried seaweed is crushed, finely ground and incorporated to the liquid stage of dissolved cellulose. The solution is spun into fibres, cured in water and then processed into staple fibres. This process firmly embeds the seaweed into the cellulose fibre and resists multiple washing cycles. All process liquids and water are recycled and re-used. All fibres and leftover waste are fully biodegradable.

Technical Description

Unlike viscose and modal, Lyocell is created by a solvent spinning technique in which the cellulose undergoes no significant chemical change. The solvent used on the manufacturing process is amine oxide. Wood pieces are debarked and chopped into wood chips which are soaked in chemical digesters that soften them into wet pulp. The pup is dried in sheets and rolled into spools. At the lyocell mill, the spools of cellulose are broken into small squares and loaded into a heated, pressurised vessel filled with amine oxide. After a short soaking time, the cellulose dissolves into a clear solution. At this stage the ground seaweed is mixed into the solution and then pumped through spinnerets. Similar to a shower head, the spinneret is pierced with small holes and when the cellulose is forced through, long strands of fibre come out. The fibres are then immersed in another solution of amine oxide which sets the fibre strands. The strands pass to a finishing area, where a lubricant is applied to detangle the strands. The crimped fibres are combed and separated before they are cut and baled for shipment to a fabric mill. The dilute solution is evaporated and 99% of the amine oxide used is recoverable in the typical lyocell manufacturing process.

Typical Applications

Seaweed is rich in essential substances such as vitamins, trace elements, amino acids and minerals. The natural moisture level of the skin enables an active exchange of these beneficial substances between fibre and skin. The high level of antioxidants in seaweed protects human skin and activates cell regeneration. The material is marketed as a "wellness textile" that is nourishing for the skin, with a smooth and silky feel. Lyocell fibres are known to be very soft, absorbent, strong when wet or dry, and crease-resistant. The fibre is used in active and sportswear, loungewear, underwear and home textiles. SeaCell LT™ contains no harmful substances therefore it is suitable for use in baby products.

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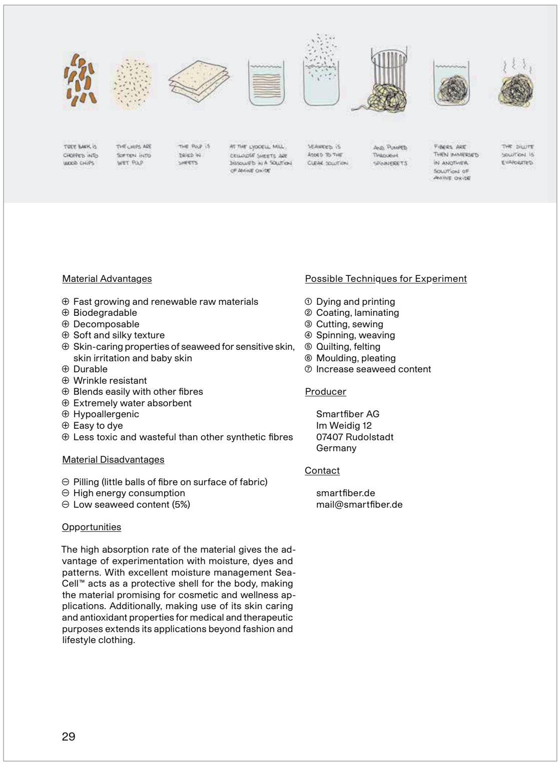



Material Advantages

⊕ Fast growing and renewable raw materials
⊕ Biodegradable
⊕ Decomposable
⊕ Soft and silky texture
⊕ Skin-caring properties of seaweed for sensitive skin, skin irritation and baby skin
⊕ Durable
⊕ Wrinkle resistant
⊕ Blends easily with other fibres
⊕ Extremely water absorbent
⊕ Hypoallergenic
⊕ Easy to dye
⊕ Less toxic and wasteful than other synthetic fibres

Material Disadvantages

⊖ Pilling (little balls of fibre on surface of fabric)
⊖ High energy consumption
⊖ Low seaweed content (5%)

Opportunities

The high absorption rate of the material gives the advantage of experimentation with moisture, dyes and patterns. With excellent moisture management SeaCell™ acts as a protective shell for the body, making the material promising for cosmetic and wellness applications. Additionally, making use of its skin caring and antioxidant properties for medical and therapeutic purposes extends its applications beyond fashion and lifestyle clothing.

Possible Techniques for Experiment

① Dying and printing
② Coating, laminating
③ Cutting, sewing
④ Spinning, weaving
⑤ Quilting, felting
⑥ Moulding, pleating
⑦ Increase seaweed content

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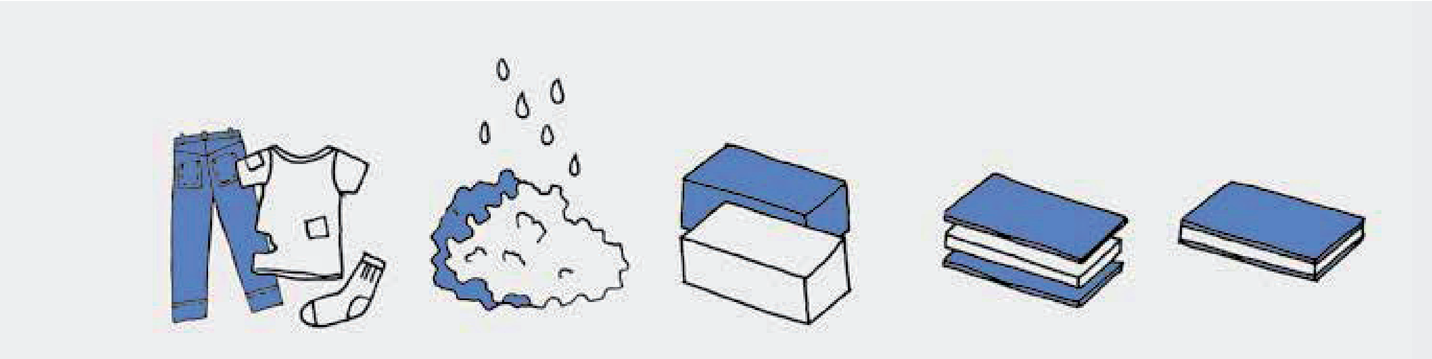
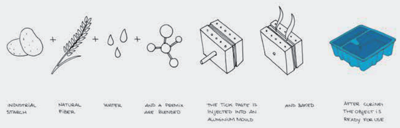


*PaperFoam®* ⓐ ③

PaperFoam® injection-moulded packaging.




Introduction

PaperFoam® is a sustainable, eco-friendly, low-carbon and highly recyclable pulp packaging material developed in the Netherlands. Using injection-moulded technology, the product combines industrial starch extracted from potatoes, cellulose fibres, water, and a premix to create a home compostable material that replaces traditional packaging products. The material is environment-friendly throughout its lifecycle. When it comes to disposal it is home compostable or recyclable with paper. Nature itself helps break down the material in a matter of weeks, pollution free and with no harmful residue.

Technical Description

The biodegradable pulp can be shaped into any form by using the injection moulding technique. The four ingredients—industrial starch extracted from potatoes, cellulose fibres, water, and a premix—are blended to form a thick paste which is injected into an aluminium mould. After the mixture has been baked at roughly 204 °C it can be removed from the mould and be ready for use. PaperFoam® weighs about 180 g/l: this translates into possible weight reductions of 40% compared to traditional packaging products. All moulds are customized according to consumer needs and any colour can be added to the mixture. With the injection moulding process it is possible to accurately emboss logos and neat text on the surface to save on labelling costs. By placing paper strips in the mould before injection, an integrated paper hinge is obtained. This improved hinge is more durable and copes well with the high-speed automated process of egg packing. Extra textures, embossed details, multiple clamping and friction fitting cavities to hold various items in place can also be easily achieved.

Typical Applications

PaperFoam® originated as a greener alternative to plastic packaging materials and its ideal application is in the packaging industry. It is used to manufacture solutions for electronics, cosmetics, medical supplies and dry foods. PaperFoam packaging reduces the weight by up to 40% compared to regular product packaging. However, reduction in weight does not compromise protection of the packaged items. Indeed, hinges, multiple clamping and friction fitting cavities are designed to protect and to firmly hold in place smartphones, wine bottles and other delicate items. Compared to other moulded paper pulp materials, PaperFoam® presents a smoother and cleaner finish. Also, the unlimited colour options give PaperFoam® a premium look, opening up the market of high-end applications while still being fully paper recyclable.

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Material Advantages

⊕ Produced with renewable ingredients
⊕ Compostable
⊕ Biodegradable
⊕ Light weight
⊕ Ensures items protection
⊕ Carbon friendly
⊕ Pleasant aesthetic and finish
⊕ Unlimited possibility to be shaped and coloured
⊕ Nonabrasive

Material Disadvantages

⊖ Limited thickness range: 2–3 mm
⊖ Low fire resistance
⊖ Low weather resistance
⊖ Low cost-effectiveness (compared to low value packaging)
⊖ Not food contact certified

Opportunities

The fine finish of the material gives limitless possibilities to work with textures and patterns. Dye is also an interesting area to further explore to challenge the aesthetic. Within the injection moulding process, it is possible to achieve interesting functional results and improve the structural performances of PaperFoam. Other applications field other than packaging could also be explored.

Possible Techniques for Experiment

① Experiment with different thicknesses
② Apply different colours to one surface
③ Print on the surface
④ Experiment with hinges and closing mechanisms

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Material Investigation

At Really end-of-life textiles are upcycled into a premium-quality and high-density engineered material suitable for industrial-scale projects. Called Solid Textile Board and produced in Denmark, this material provides a solution to a real problem: nowadays only 25% of the 95% of textiles that can be recycled actually are. Really represents the move to a circular economy where textiles instead of rotting away or ending up in landfills acquire a new life. The core of the Solid Textile Board is made from end-of-life cotton coming from the fashion and textile industries, industrial laundries and households and its outer layer is available in four colour variants: Cotton White, Cotton Blue, Wool Slate and Wool Natural. Brands, designers and architects have been exploring and challenging this material as a sustainable alternative to wood and composites for furniture and architecture applications. All the experiments and achievements completed so far have been collected into a guideline manual that can be used as inspiration and as a reference tool for those, such as me, approaching Solid Textile Board for the first time. I started my experimentation going through the manual, studying the current knowledge on how to work with Solid Textile Board. I then followed my instinct to act on the material using common work tools and trying out other instruments and machine settings which could potentially reveal new aesthetic and functional findings. Worthy of note is that grooves add flexibility and allow 2D boards to be curved. Groove depth, width and spacing will determine a different level of flexibility and aesthetic results. Glue works very well to join and assemble the boards. Screws, bolts, dowels and nails can also be used. Chamfered and rounded edges are easy to achieve and small cuts, scratches or drills on the surface create interesting surface textures. I experimented with volumes by layering and spinning on the lathe. I also tested the laser machine, finding out that engraving can work very well for certain applications such as patterns or branding. The CNC machine can also be used to explore complex shapes and details. However, it is important to set the CNC blades correctly to ensure clean edges. In parallel, handcrafted methods such as carving and inlaying can lead to very unique aesthetics. This material has a lot of potential but also shows some limits: the heat from a laser cutting machine can burn it and the water used during the dying process can badly affect its properties and ruin the aesthetic.

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