Bio-Based materials

A research for the future

PARKASSOCIATI

Indice

01

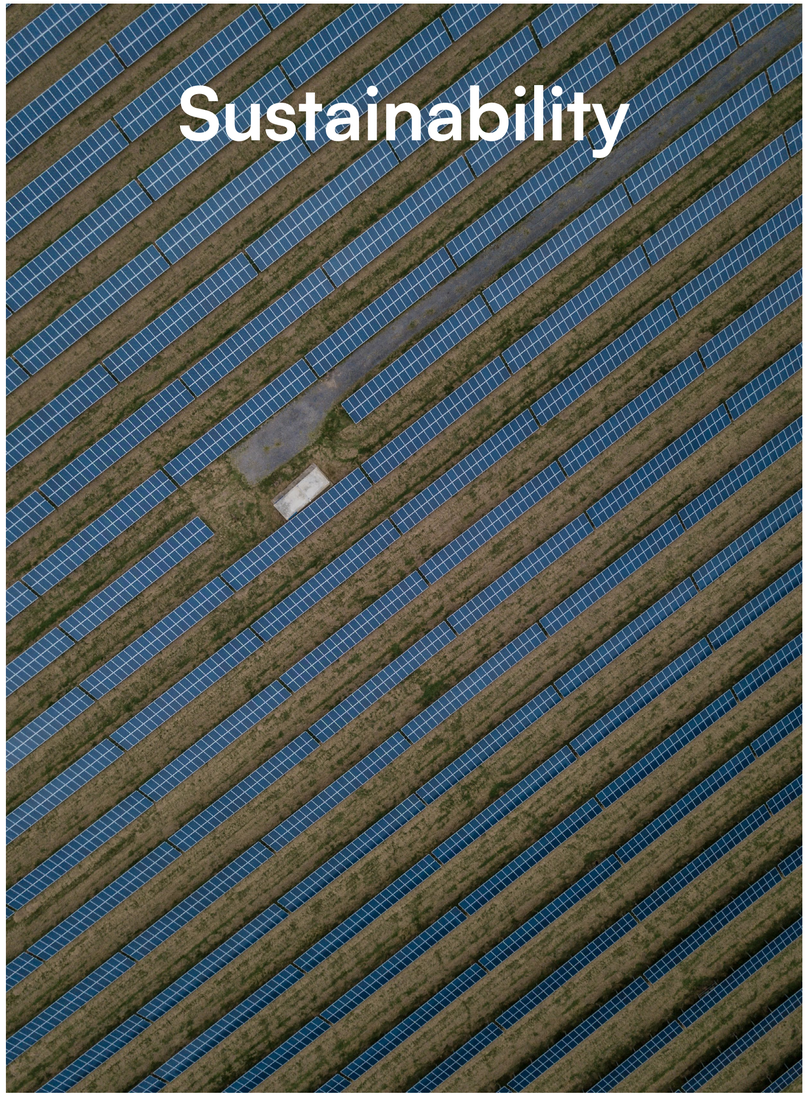
Bio-Loop

Bio-Loop

It can be interpreted as a concept related to the circular economy, sustainability, or biological processes. In the context of sustainability and waste management, the bio loop may refer to the use of organic waste materials or biomass as a resource for creating new products, energy generation, or returning nutrients back.

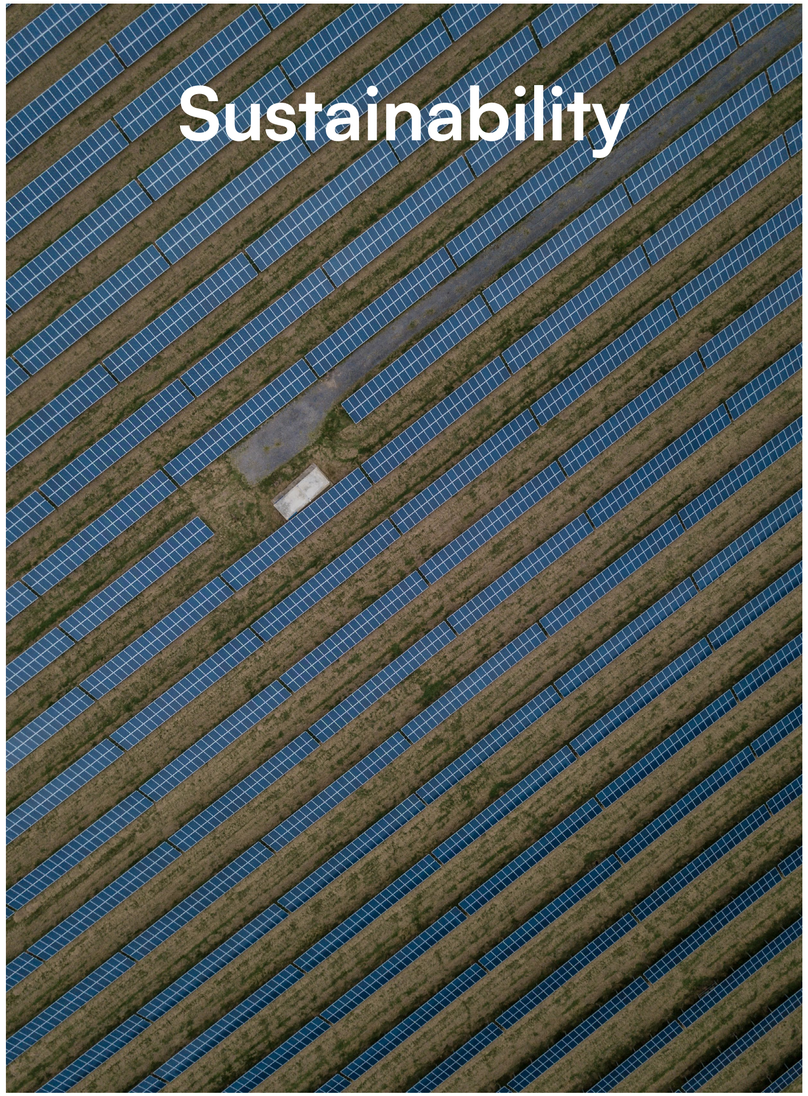
In a bio loop, organic materials, such as food waste or agricultural residues, are treated through various processes such as composting, anaerobic digestion, or bioconversion. These processes help break down the organic matter, extracting value from it in the form of compost, biogas, biofuels, or other bio-based products. By closing the loop on organic waste, the bio loop aims to minimize waste, reduce reliance on fossil fuels, and promote a more sustainable and circular approach to resource utilization.

‘It’s not just our diets which need to change to tackle the climate emergency.’
Dan Stokes, writer for the Architects’ Journal


Sustainability


Circularity


Regeneration


Sustainability

Circularity

Regeneration

There’s something inherently problematic in the framing of sustainability that implies the best you can aspire to is neutrality, and anything less than that is just part of a degenerative downward cycle.

Sustainability

Circularity

Regeneration

Circular design is a framework that tackles global challenges including climate change, biodiversity loss, waste, and pollution. Design is an essential element of developing a circular economy that is restorative or regenerative by value and design.

Sustainability

Circularity

Regeneration

By centring regeneration in the home - a space we engage with on a daily basis, which represents stability, security and comfort for the most fortunate - we can begin to break down the myths associated with regeneration, and show how everyone has a stake in its future.

Global Challenges

The era of limitless economic growth has reached its conclusion. Five decades ago, The Limits to Growth (Meadows, Meadows, Randers, & Behrens III, 1972) predicted that our planet's boundaries cannot sustain indefinite economic and population expansion. In 2015, global leaders attending the Paris UNFCC conference COP21 became acutely aware that their development plans clashed with the Earth's carrying capacity. This realization prompted the adoption of the Paris Agreement, a binding international treaty involving 196 Parties committed to combating climate change.

The emergence of humanity as a significant force capable of transforming the planet, known as the 'Anthropocene,' has occurred at an unprecedented magnitude, scale, and pace, contrasting with the geological forces of the past like volcanism and ice ages. We currently confront multiple crises encompassing climate change, biodiversity loss, and resource depletion. Urgent action is imperative, but meaningful resolutions require a profound transformation of sociotechnical systems. Climate change has rightfully been identified as the most urgent challenge of our time, leading governments to launch ambitious policies. For instance, the EU Green Deal (2019) aims to achieve a 55 percent reduction in greenhouse gas (GHG) emissions by 2030 (compared to 1990 levels).

A circular economy is a deliberate and purposeful industrial system that prioritizes restoration and regeneration. It rejects the notion of “end-of-life” and instead focuses on restoring materials and products. The primary objective is to eliminate waste by emphasizing superior material and product design, as well as innovative business models.

02

Bio-Based

Bio-based materials are the bridge between technology and nature, unlocking a future where sustainability and progress coexist.

Concept of bio-based

Bio-Baseds are materials derived from renewable biological resources, such as plants, animals and microorganisms; they can be used to replace traditional petroleum-based ones, in a wide range of applications, including packaging, textiles, construction and consumer goods.

The products of the organic supply chain boast a lower environmental impact thanks to the recycling of organic and natural substances. However, it is important to consider the entire life cycle of these materials, including their production, use and disposal, to fully assess their sustainability. Bio-Based materials are increasingly used in architecture as sustainable alternatives to traditional building materials.

The use of bio-based materials in architecture can help reduce the environmental impact of buildings and promote sustainability However, it is important to consider the entire life cycle of these materials, including their production, transport and disposal, to ensure their sustainability.

Origins

Biomaterials can be derived from various sources, each with its own distinct origin and properties. Plant-based biomaterials, such as cellulose, lignin, or starch, offer a sustainable and renewable option for applications ranging from packaging to textiles. The animal-based biomaterials, including collagen, chitin, or silk, possess unique properties suitable for medical, cosmetic, and industrial uses. Moreover the microbial biomaterials produced by bacteria or fungi find application in the production of bioplastics, biofilms, and bioadhesives.

Recycled biomaterials, derived from waste materials, contribute to the circular economy and environmental sustainability. Hybrid biomaterials, composed of a combination of different biomaterials, offer tailored properties and functionalities. The choice of biomaterial origin depends on the desired properties, application requirements, sustainability goals, and resource availability, showcasing the diverse range of options available in the field of biomaterials.

Agriculture

Nature

Earth

Sea

Agriculture

Agricultural biomaterials refer to biomaterials derived from agricultural resources, encompassing various plant-based materials and by products. The use of agricultural biomaterials promotes the utilization of renewable resources, reduces dependency on fossil fuels, and offers environmentally friendly solutions for various industries.

Nature

Earth

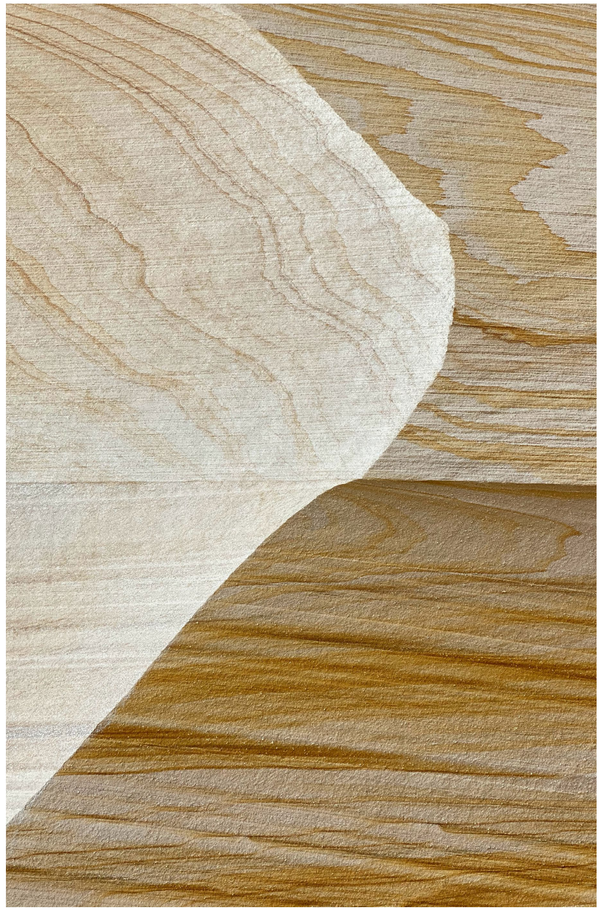
Sea

Agriculture

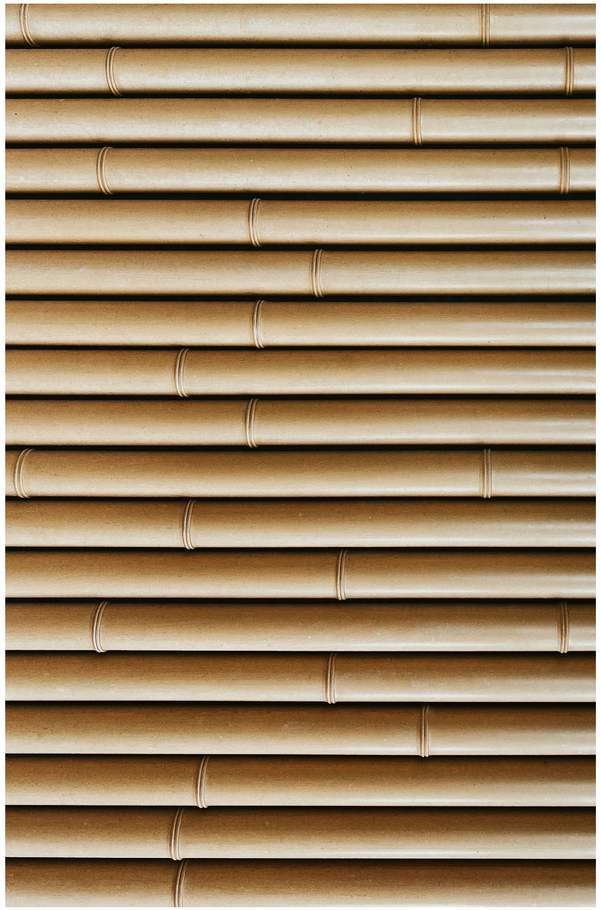
Bio-based materials derived from agriculture are gaining significant attention as sustainable alternatives to conventional materials. These materials are obtained from various crops, plants, and agricultural by-products, harnessing the renewable resources offered by the agricultural sector. These bio-based materials not only provide sustainable solutions but also offer desirable properties such as strength, durability, thermal insulation, and aesthetic appeal. By utilizing agricultural resources, these materials contribute to a circular economy, reducing waste and promoting a more environmentally friendly approach to material sourcing and production.

The use of bio-based materials derived from agriculture holds promise for industries such as construction, design, packaging, textiles, and more. As society continues to prioritize sustainability, these materials play a vital role in driving the transition towards a more eco-friendly and resource-efficient future.

Agriculture



Wood: Wood is a renewable resource that has been used in architecture for centuries. It is a popular choice for building structures, such as roofs, walls and floors, and is known for its natural beauty and durability.



Bamboo: Bamboo is another renewable resource that is popular in architecture. It is growing rapidly and can be used for a variety of applications, such as floors, walls and roofs.

Cork: Cork is a natural material that is harvested from the bark of cork oaks. It is a light, strong and sustainable material that can be used for flooring, insulation and soundproofing.

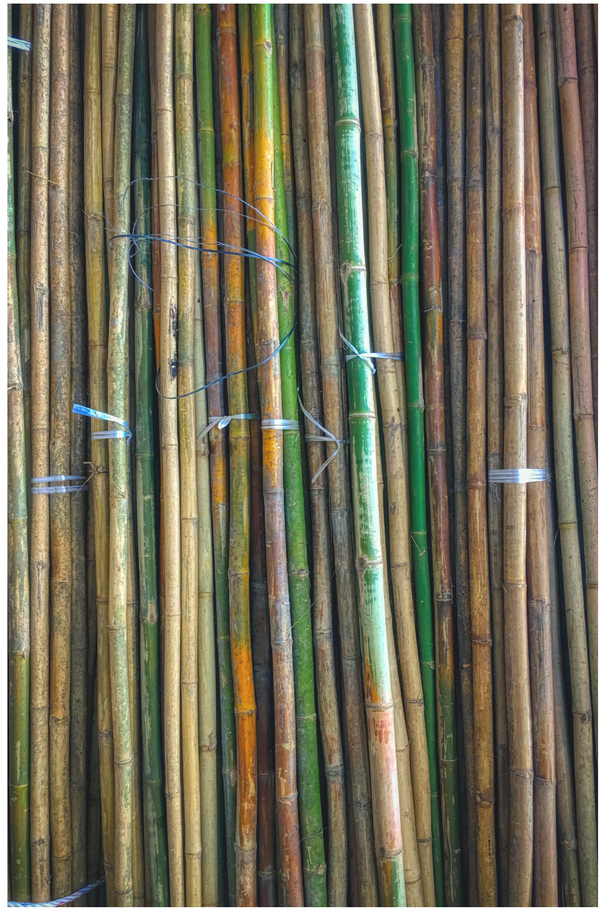
Straw bales: Straw bales are compressed and bound straw, typically wheat or rice straw. They are used as building blocks for walls, offering good insulation properties and contributing to energy-efficient construction.

Agriculture

Straw: Agricultural straw, such as wheat, rice, or barley straw, can be used to produce straw bales, which are utilized as building blocks for walls in construction. Straw can also be processed into straw composites or used for thermal insulation.

Corn Starch: Corn starch is a widely used bio-based material derived from maize. It can be transformed into bioplastics, biodegradable packaging materials, or used as a binder in manufacturing processes.

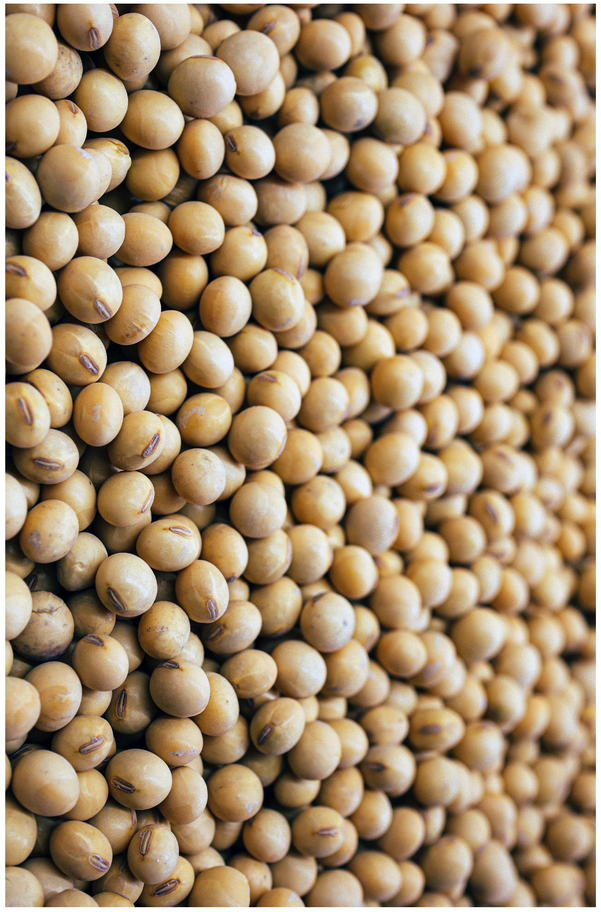
Flax: Obtained from the flax plant, can be used to produce biocomposites and textiles. Flax-based materials offer strength, durability, and a natural aesthetic, making them suitable for applications such as flooring, wall panels, or furniture.



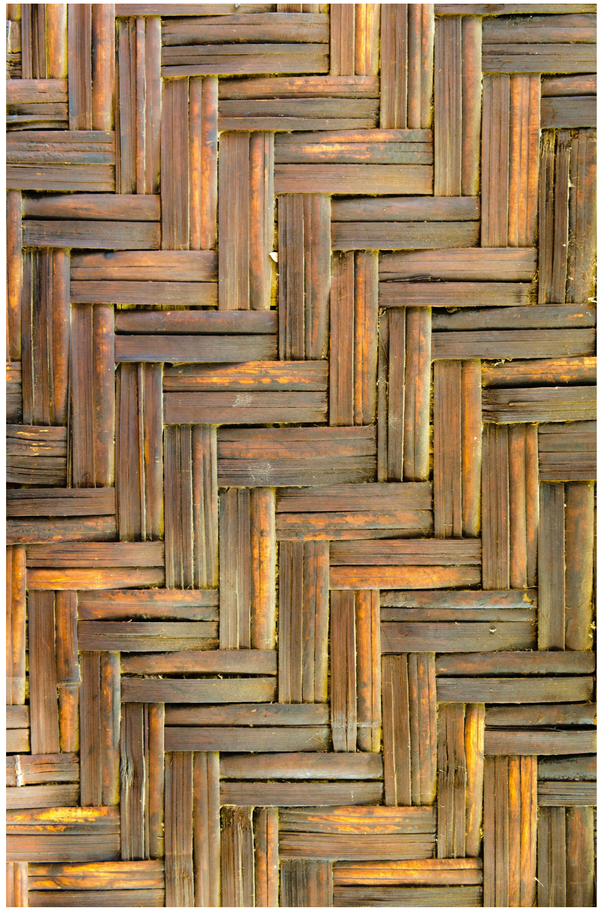
Sugarcane Bagasse: The fibrous residue left after extracting juice from sugarcane, can be transformed into bio-based materials. It can be used in the production of bio-based plastics, paper products, or as a source of bioenergy.

Agriculture

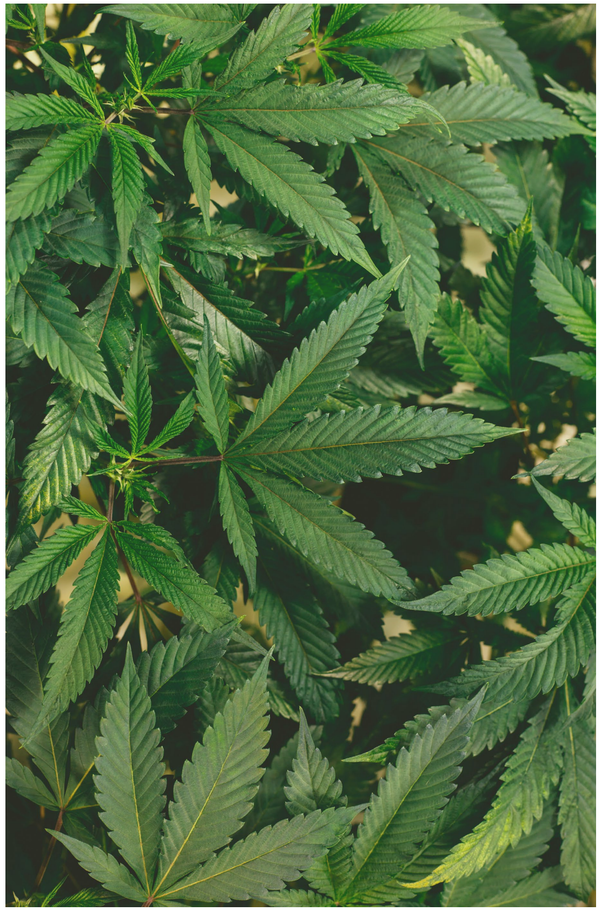
Jute: Is a natural fiber obtained from the jute plant. It can be used to create biocomposites, textiles, and geotextiles. Jute-based materials are commonly used in packaging, carpeting, and erosion control applications.



Soybean Oil: Derived from soybeans, can be used as a bio-based binder or additive in various materials. It is often used in the production of bio-based foams, adhesives, and coatings.



Palm Fiber: Obtained from the waste product of oil palm cultivation, can be processed into bio-based materials. It can be used for insulation, packaging, or in the production of biocomposites.



Hemp: Derived from the hemp plant, can be used in the production of bioplastics, textiles, and construction materials. Hemp-based materials offer strength, durability, and thermal insulation.

Agriculture

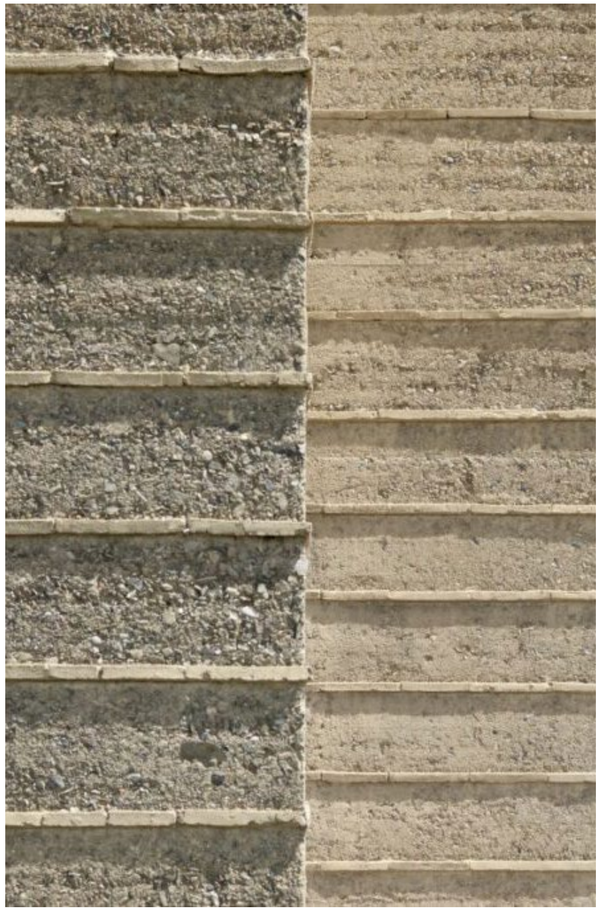
Wadden Sea Centre, Dorte Mandrup

Kairos, Kairlin panel

Resysta, UPB boards

Agriculture

Kairos Straw Panels



House Rauch, Martin Rauch, Schlins (Austria)

Hemp Plaster

Rice House

Agriculture

Nature

Natural materials refer to materials that are derived from renewable biological sources and exhibit natural properties. These materials are often preferred due to their sustainable nature, reduced environmental impact, and biodegradability.

Earth

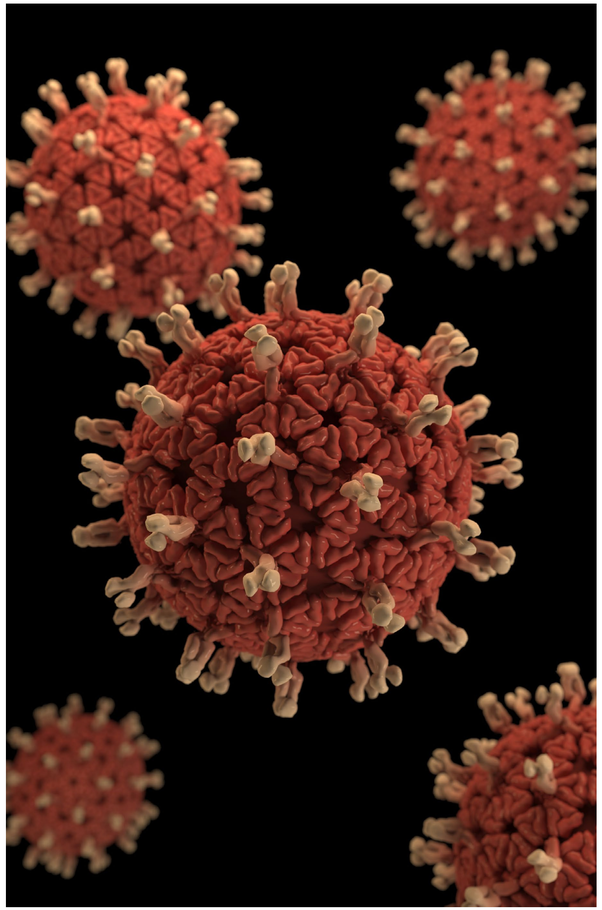
Sea

Nature

Bio-based materials derived from natural sources are gaining recognition as sustainable alternatives to traditional materials. These materials are derived from renewable resources found in nature, such as plants, animals, and microorganisms. Animal-based materials such as wool, silk, and leather find applications in fashion, upholstery, and interior design. Moreover, these materials utilize parts of animals or by-products from the meat and dairy industries, reducing waste and promoting resource efficiency.

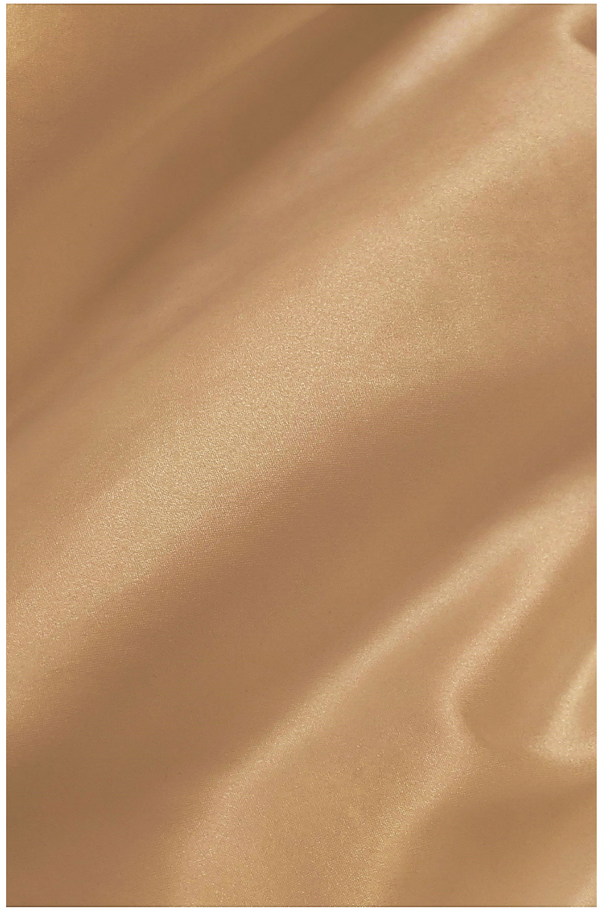
Bio-based materials derived from natural sources exhibit a range of desirable properties, including biodegradability, recyclability, low carbon footprint, and non-toxicity. They can be processed, modified, and combined with other materials to enhance their performance and meet specific application requirements.

Nature



Microorganisms: Bacteria can be utilized as biobased materials in various applications. To produce bioplastics, textiles, paper to bioconcrete where in the bioconcrete the bacteria contained can repair cracks in the material.

Wool: Derived from the fleece of sheep or other animals such as alpaca, cashmere goats, or angora rabbits. It is a natural fiber known for its insulation properties and is commonly used in textiles, garments, carpets, and upholstery.



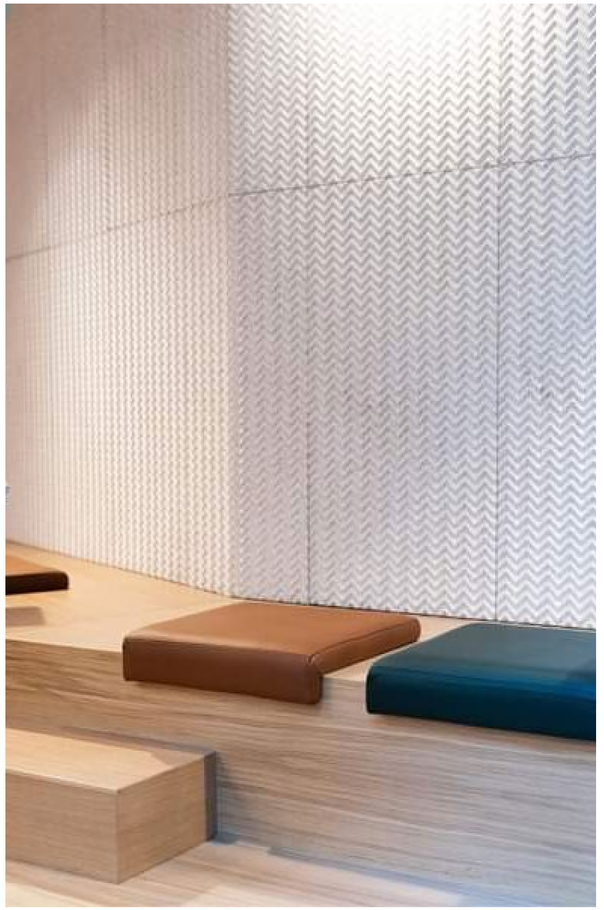
Silk: Is produced by silkworms and is known for its lustrous appearance and smooth texture. It is used in the production of fabrics, luxury clothing, and high-end home furnishings.

Chitin: Fibrous substance in the exoskeleton of crustaceans, insects, and the cell walls of fungi, is the second-most abundant biopolymer globally. However, it must undergo chemical extraction to be transformed into a usable material.

Nature

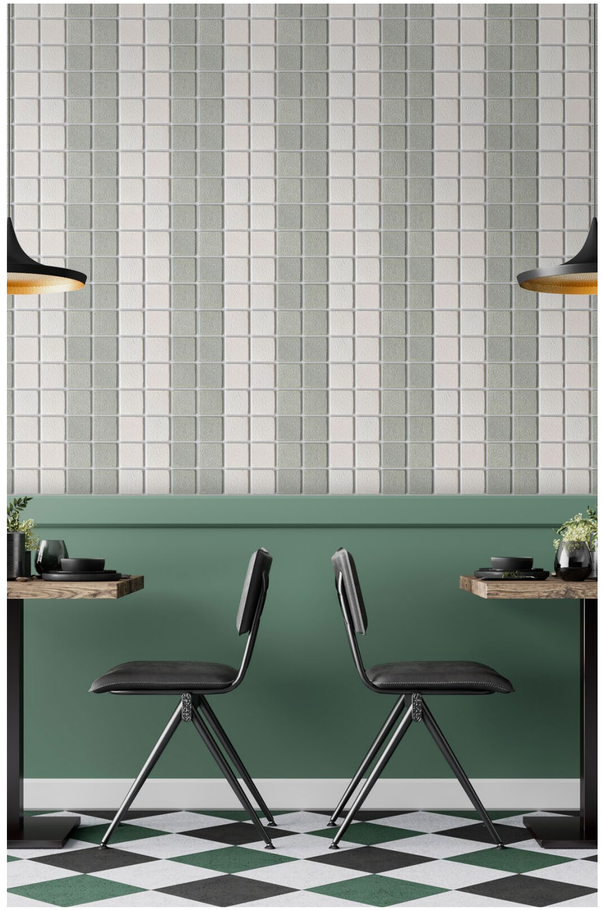
Milleforma. cotton acoustic tiles

Mogu, Pluma panels



Baux, acoustic pulp panels

Nature



Milleforma Tiles

Milleforma Tiles

Micelium Floor, Mogu

Micelium Floor, Mogu

Agriculture

Nature

Earth

Refer to materials derived from natural sources found on Earth. These materials often have low embodied energy, are locally available, and contribute to the development of environmentally friendly practices in various industries.

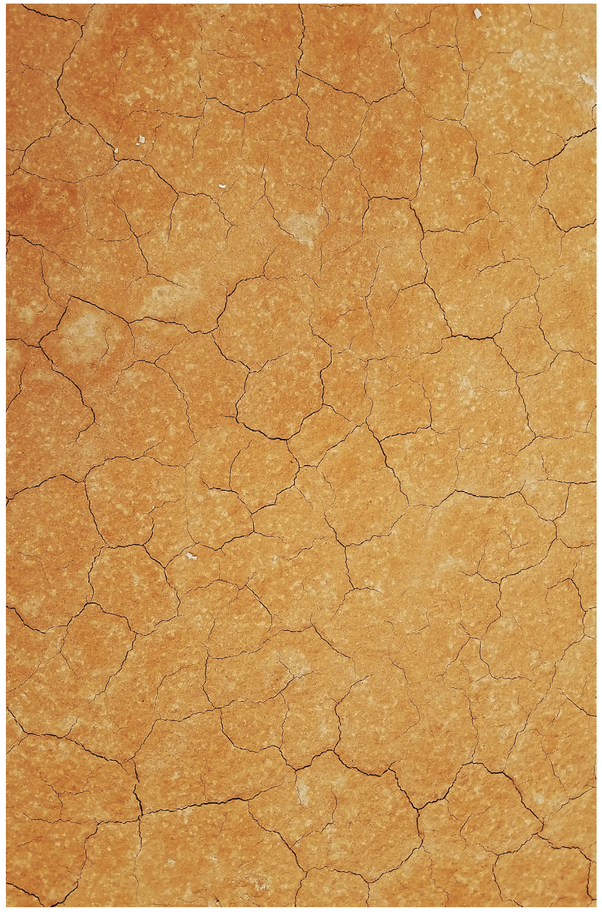
Sea

Earth

The term unfired earth means clay that has been worked and allowed to dry naturally, without any other type of firing. The beaten earth containing 10 percent water is placed in formwork and allowed to compact. Both load-bearing and curtain walls can be made with Pisé, and lean clay is generally used. After curing, the raw earth mix for Pisé generally involves the addition of straw. Wooden laths can be used at technological nodes where reinforcement is needed.

A fat, sandy earth is preferable for making bricks, while a leaner, gravelly texture is suitable for Pisé. The weak point of raw earth occurs when it comes into contact with water, compromising strength and performance. Particular additives, including those of natural origin, can be used to solve this problem: we talk about substances of a colloidal nature such as mixtures of water with flours, starches, ash, casein, albumin, methylcellulose, and potassium or sodium silicates.

Earth



Rammed Earth: is a construction technique that involves compacting a mixture of soil, clay, sand, and gravel into solid walls. It is a sustainable and durable material that provides excellent thermal mass and natural insulation.

Adobe: is a traditional building material made from a mixture of clay, sand, water, and organic fibers such as straw or grass. Adobe offers good thermal performance and is commonly used as bricks in arid regions.

Cob: is a mixture of clay, sand, and straw that is used to build walls. It is typically hand-formed into lumps or to create thick, monolithic walls. Cob construction is known for its thermal mass, natural aesthetic, and low environmental impact.

Hempcrete: is a bio-composite material made from the inner core of hemp plants, called the hurd, mixed with lime and water. It is lightweight, breathable, and has good insulation properties.

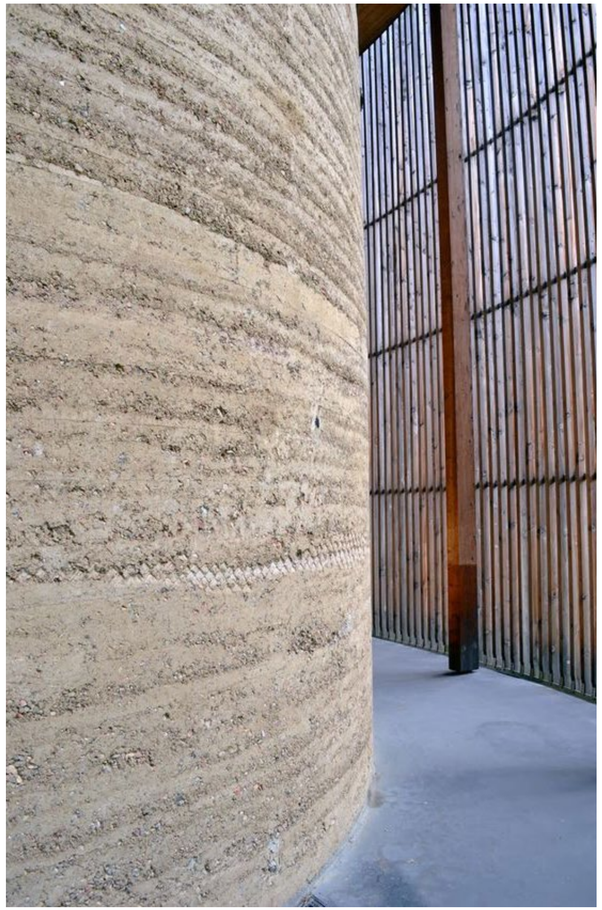
Earth

Vernacular House, Angels Castellarnau Visus, Spagna

BC Materials Forniture

BC Materials Floor

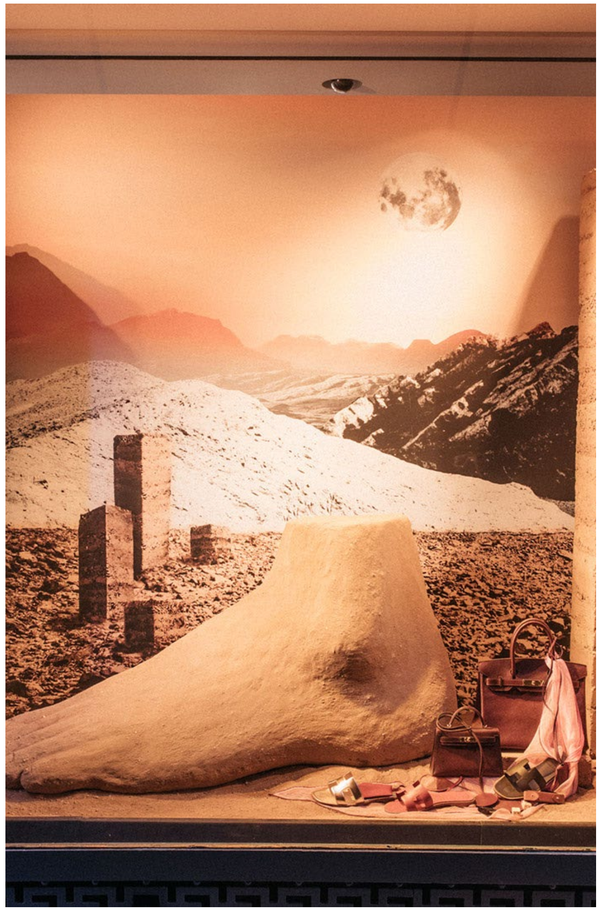
Earth



Chapel of Conciliation, Sassenroth Reitermann, Berlino

Primary School, Gando Burkina Faso, Francis Kéré, Rammed Earth Bricks

Countertop bar, BC Materials



Hermès Shop, BC Materials

Agriculture

Nature

Earth

Sea

They utilize marine resources, which are often abundant and renewable, and can contribute to the development of environmentally friendly practices.However, it is important to consider the sustainability and responsible harvesting of marine resources to ensure the long-term health of marine ecosystems.

Sea

The seafood industry is among the most environmentally problematic due to the large amount of waste resulting from fish processing, and more: it has been estimated that between 20 and 80 percent of the catch, depending on the species, is thrown away. Among the “waste” are skins, entrails, shells, and viscera. Some of it, especially abroad is thrown directly into the sea, and some is sent to landfills and disposal sites, which are not always easy to find and manage, with high costs, including energy costs.

Scientific and industrial efforts are proliferating worldwide, beginning in countries like Canada, with the aim of transforming waste materials from mere disposables into valuable raw materials. In essence, fish waste can has the potential to play an opportunity role in the circular economy and recycling processes.

Sea

Seaweed: Is an exceptional insulating material. It is non-toxic, inherently fire-resistant, and possesses remarkable acoustic properties. It possesses the capability to absorb and release moisture, thereby assisting in maintaining a balanced indoor climate.

Marine Biomass Fibers: Fibers extracted from marine biomass, such as seagrass or kelp, can be used to produce textiles, ropes, and composites. These fibers are renewable, biodegradable, and have low environmental impact.

Marine Sponges: Produce collagen, which can be extracted and used in the production of scaffolds for tissue engineering. It offers potential as a sustainable and biocompatible material for biomedical applications.

Biominerals: Some marine organisms, like corals and mollusks, produce biominerals such as calcium carbonate. They can be used as sustainable alternatives for construction, architecture, and 3D printing.

Sea

Scale, Scalite tiles

Scale, Scalite tiles

Gwilen forniture

Materials from different origins, that are 100% bio-based, without any type of non-natual additive that compromise it’s composition. Variuos uses linked to the material’s characteristics. They are use for insulation, cladding, plaster, construction bricks, furniture, tiles, etc.

Typology

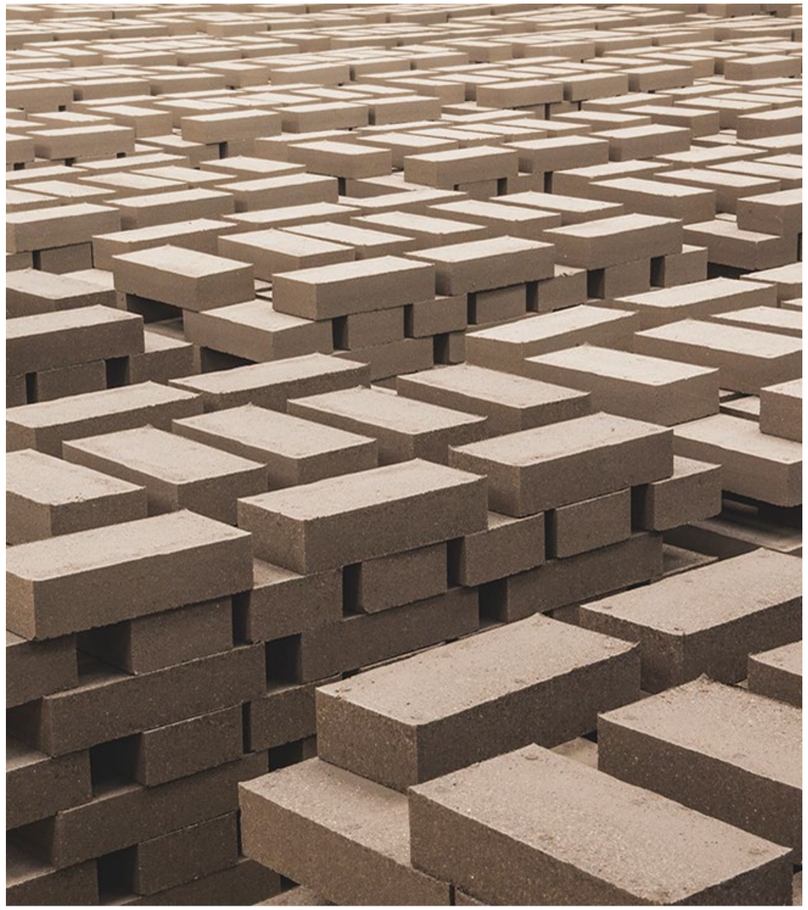
Biobased materials are increasingly being incorporated into various architectural applications, offering sustainable alternatives to conventional materials. In architecture, biobased materials find typologies of use in structural elements, insulation, cladding, flooring, interior finishes, and even furniture. In structural applications, engineered wood products, such as cross-laminated timber (CLT) and laminated veneer lumber (LVL), provide strength and stability while reducing the carbon footprint. These materials are used in the construction of walls, roofs, and floors, offering a renewable and low-emission alternative to steel and concrete.

Biobased insulation materials, including cellulose fibers, hempcrete, and straw bales, offer excellent thermal performance and can be used in walls, roofs, and floors to improve energy efficiency and reduce reliance on fossil fuel-based insulation materials.For cladding and façade systems, biobased materials such as bamboo, wood siding, and shingles made from recycled wood can be used, providing natural aesthetics, durability, and sustainability. In interior finishes, biobased materials like cork, linoleum, and natural fiber carpets offer eco-friendly options for flooring, while biobased paints, coatings, and adhesives provide low-VOC (volatile organic compounds) alternatives for surface finishes and bonding.

Additionally, biobased materials are being explored for furniture and product design, with designers utilizing materials such as mycelium, bamboo, clay, rice, and bioplastics to create sustainable and biodegradable furnishings.

Typology

Bricks



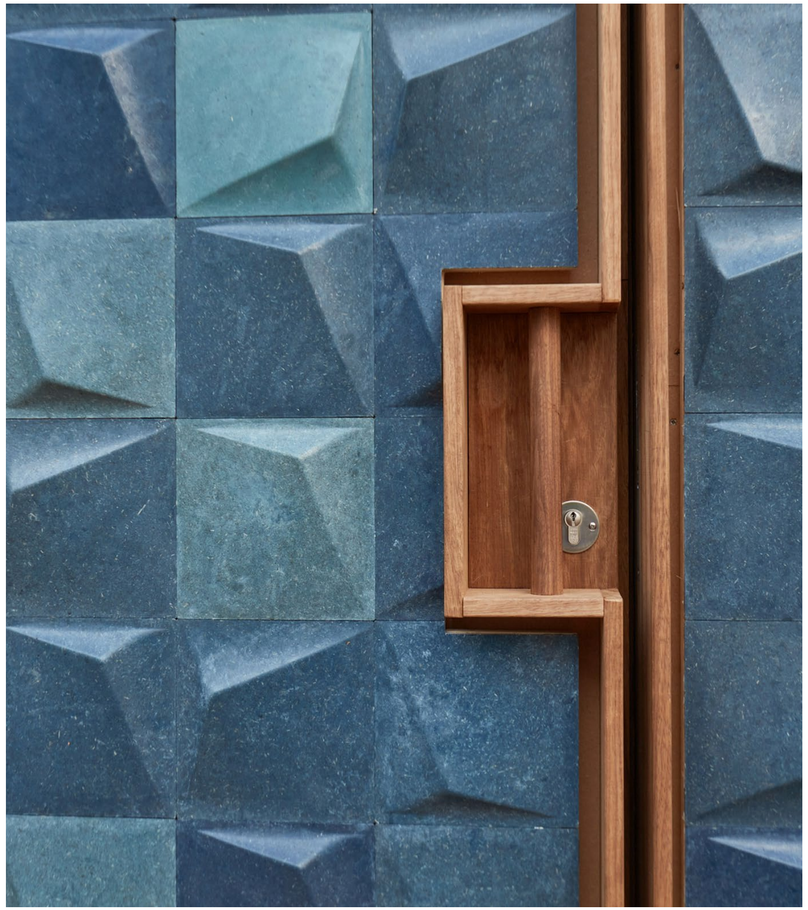
Rammed Earth: Are a type of construction material made by compacting a mixture of earth, such as clay, sand, gravel, and sometimes organic additives, into solid blocks. The process involves layering the earth mixture into formwork and then compressing it with hand-held or mechanical tampers.

Rice: Has been utilized as a key ingredient in the production of bricks, specifically known as rice husk ash bricks. Rice husk is the outer protective covering of rice grains and is often considered as agricultural waste. However, it can be transformed into a valuable resource for sustainable brick manufacturing.

Biocement: Is produced through a biological process involving the activity of microorganisms. These microorganisms, typically bacteria, help bind loose particles together, resulting in a solid and very durable material.

Typology

Cladding



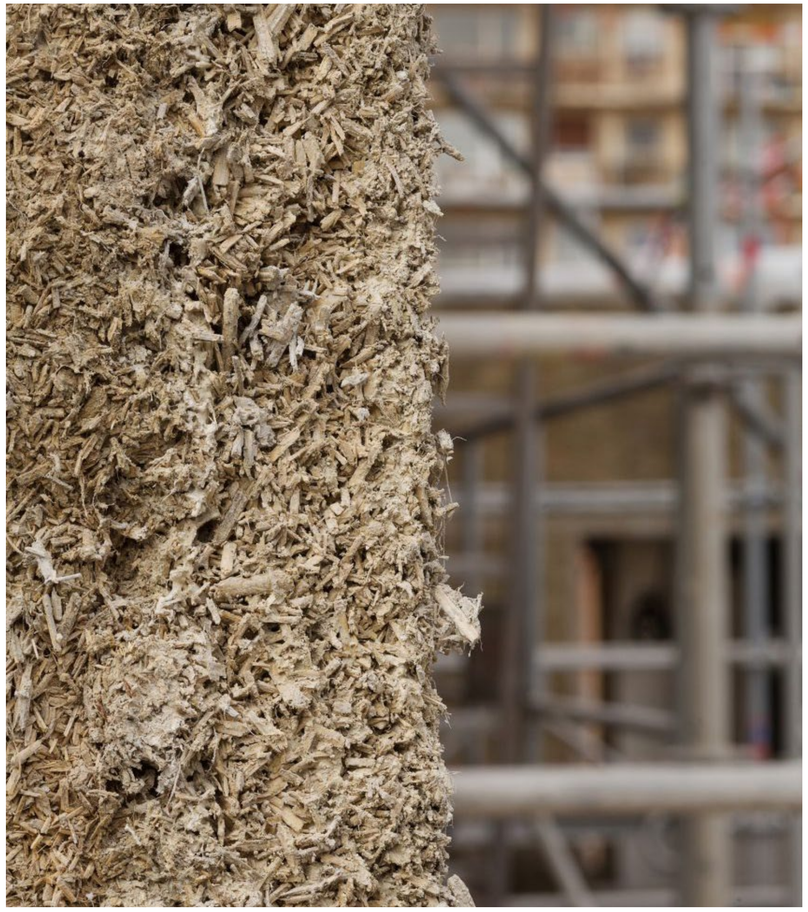
Rice: Combine sustainable practices with functional and aesthetic properties, making them an appealing choice for environmentally conscious construction projects. They offer a range of benefits, including lightweight construction, insulation, moisture resistance, and potential fire resistance.

Cork: Cork cladding combines sustainability, thermal and acoustic insulation, durability, and aesthetic appeal. It offers a natural and unique finish while providing functional benefits that contribute to the comfort and performance of the building envelope.

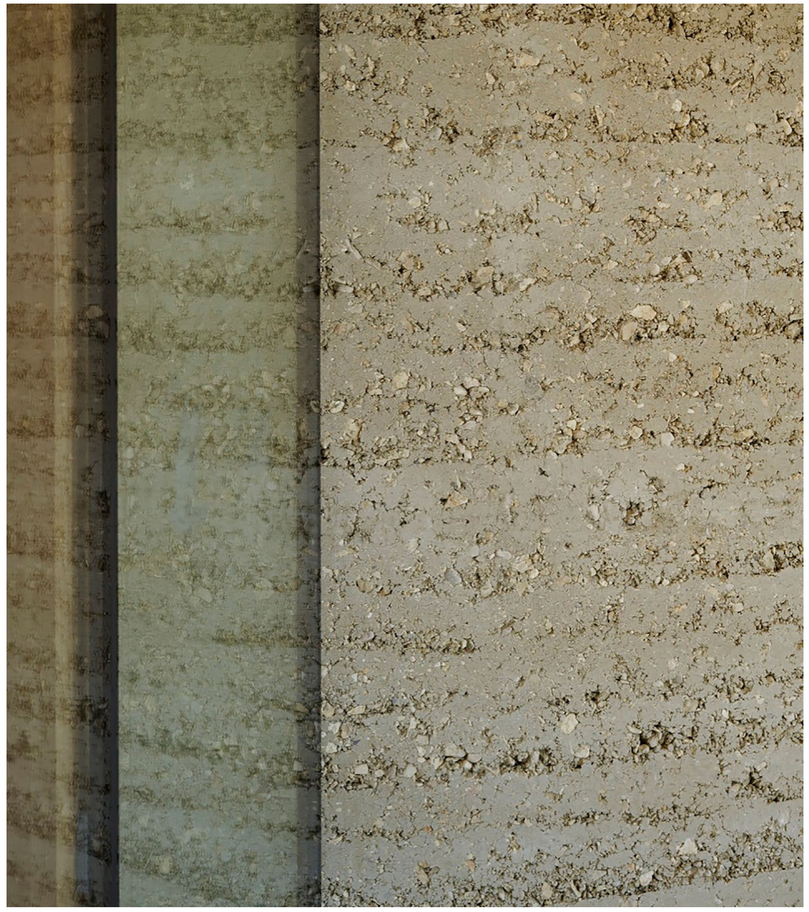
Straw: Its natural insulation properties, low carbon footprint, and cost-effectiveness make it an attractive choice for eco-conscious construction projects seeking to combine environmental responsibility with innovative design.

Typology

Plaster



Hemp: Refers to a type of plaster made from a mixture that incorporates hemp fibers as a key ingredient. Hemp, derived from the Cannabis sativa plant, has been used for centuries in various applications, including construction.

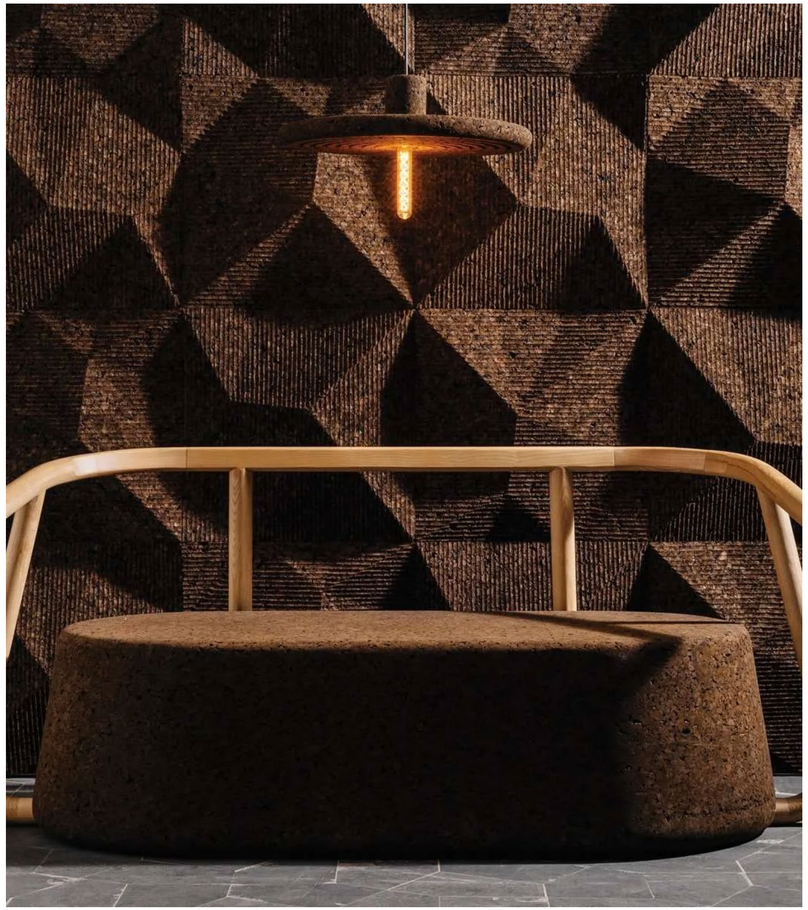


Earth: Earth plaster, is a traditional building material made from a mixture of sand, and other natural ingredients. It has been used for centuries as a finish for interior and exterior walls. When using earth plaster, it is important to consider proper surface preparation, and protection against excessive moisture.

Clay: Is highly breathable, allowing moisture vapor to pass through the material. It helps regulate indoor humidity levels by absorbing excess moisture and releasing it back into the environment when conditions become drier. This can prevent the buildup of moisture and inhibit the growth of mold and mildew.

Typology

Furniture



Chair

Lamp

Support

03

Circularity and biobased

With the rise in awareness, research, and funding dedicated to bio-based materials, the significance of how these cutting-edge materials can contribute to closing material loops and tackling environmental concerns has grown substantially.

Circularity and biobased

Biobased materials encompass materials derived from renewable biological sources such as plants, wood, and organic waste, making them ecologically preferable to certain other materials. To assess their environmental impact and relevance in the context of a circular economy, tools like Life Cycle Assessment (LCA) play a pivotal role. LCA is a widely used technique that evaluates the environmental effects associated with each stage of a product's life cycle, from raw material extraction and manufacturing to distribution, use, repair, and disposal.

In the pursuit of a circular economy, which strives to optimize resource value and lifespan while minimizing waste through material regeneration, it becomes crucial to develop tools that can measure the circular economy's contributions.

As the development and application of biobased materials are still relatively nascent, further research is necessary to determine their sustainability in comparison to existing materials and how they can offer options and opportunities for a more circular economy and society.

Materials

Components

Process

Materials

The introduction of new materials in construction, untested and without a history of durability, along with the recycling of materials not originally designed for construction purposes and the emergence of biobased materials, presents a significant challenge to the construction industry’s capacity for innovation.

Components

Process

Materials

Moving from recycled materials to biobased materials and composites, the range of commercially available materials in construction continues to expand, opening up opportunities for reuse, recycling, and repurposing. Materials such as sawdust, timber, clay, brick, mycelium, and kelp are now being explored. An inspiring example is the studio Emerging Objects, which explores innovative recipes for 3D printing using materials like coffee grounds, salt, tea, and rubber, even printing entire self-standing structures in the desert.

Choosing materials with high potential for circularity is a crucial step towards facilitating a circular design economy by ensuring their reusability. Factors such as sourcing, production methods, and lifecycle considerations play a vital role in determining circular qualities. Biobased materials are currently at the center of discussions. The European Union defines biobased materials as derived from biomass, offering a broad framework for operation. However, it is important to note that being biobased does not automatically imply biodegradability or extended circular lifecycle, nor does it specify a fixed mixing ratio for composite materials. Material choices serve as a crucial first stepping stone when considering circularity in design and architecture.

Materials

Components

In order to achieve circularity in the construction industry, it is crucial to prioritize the maintenance and reuse of components. Repurposing components that are not traditionally associated with architecture can result in extraordinary and unpredictable material expressions.

Process

Components

Achieving circularity in the construction industry requires the essential practices of maintaining and reusing components, regardless of whether they are biobased or not. To establish this as the industry's standard operating procedure, it is crucial to signal, communicate, and make available a wide range of reusable components to professionals and clients. Clients, who may initially hesitate, can be more easily persuaded to incorporate reused items when they are captivated by the unique material character of salvaged components. However, setting up databases, physical storage facilities, digital twins, and conveying material qualities through digital means present significant challenges that need to be addressed. Additionally, the individual components' uniqueness, material heterogeneity, and variations in quality inherent in component reuse must be assessed on a case-by-case basis.

Another noteworthy approach is the reverse-engineered strategy, where buildings are designed from the outset as material banks, considering future demolition and reinterpreting designs as future sources of reusable components. This strategy involves oversizing components to enhance their suitability for future reuse, maximizing their adaptive potential. Embracing buildings as material depositories and developing the necessary logistical infrastructure to support component reuse requires the development of new operational systems and design strategies.

Materials

Components

Process

In order to achieve circularity in the construction industry, it is crucial to prioritize the maintenance and reuse of components. Repurposing components that are not traditionally associated with architecture can result in extraordinary and unpredictable material expressions.

Process

Incorporating circularity and biobased materials into our design practice necessitates a shift in thinking, expanding from design thinking to system thinking and considering the lifecycle and cyclical flows of materials and components. Process plays a vital role, emphasizing the relationship between bio-materials, components, design qualities, and fabrication, rather than solely focusing on style. To maximize circularity in projects, design and manufacturing must align material and component usage, treating different aspects in a unified and holistic manner.

Computation and digital fabrication offer valuable tools for optimizing efficiency, production, and performance, reducing material waste through the design of CNC-based workflows. Embracing emerging technologies requires adaptation from designers, tradesmen, and manufacturers, managing increased logistics, labor, and complexity. This shift also necessitates expanding networks and fostering collaboration to overcome the current limitations in contact points and large-scale networks. It is important to acknowledge that designing for disassembly may require additional input, time, and labor. The industry, professionals, and clients must recognize these realities and their implications. Engaging clients early in the process, even before specific projects are commissioned, is crucial. Initially, clients may be hesitant to accept a certain level of managed “unpredictability” in materials or components, but their commitment is essential to successfully navigate these processes.

Bio-based materials exhibit distinct characteristics compared to finite materials like metals and fossil fuels. Bio-based materials are often heterogeneous, also they show varying behavior, and have a shorter lifespan. These unique properties can pose good challenges for architecture.

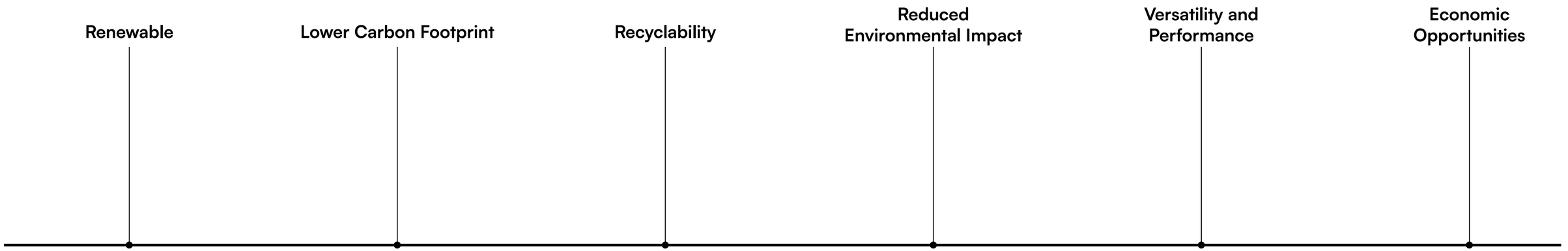
Advantages of bio-based

The pressing issue of climate change and the depletion of finite resources has created an urgent imperative to seek viable alternatives to fossil-based raw materials. Bio-based raw materials provide a promising solution, facilitating a transition away from fossil fuels and supporting the development of a more sustainable society.

A notable advantage of bio-based materials is their superior recyclability compared to their fossil-based counterparts. Additionally, their production processes, which leverage biologically derived methods such as enzymes, fermentation, and bio-catalysis, often result in higher process efficiency and may contribute to a reduced carbon footprint.

Furthermore, bio-based materials have the potential to exhibit lower toxicity levels compared to traditional materials. They also possess unique properties, including biodegradability, which aligns with the principles of a circular economy and promotes environmental sustainability.

Advantages of bio-based



The existing built environment demands more than just rigid and unchanging materials. It needs bio-based materials that are capable of self-regenerate, grow, and adapt in accordance with their surroundings. This vision presents an intriguing possibility for a sustainable future.

Scale_Scalite tiles

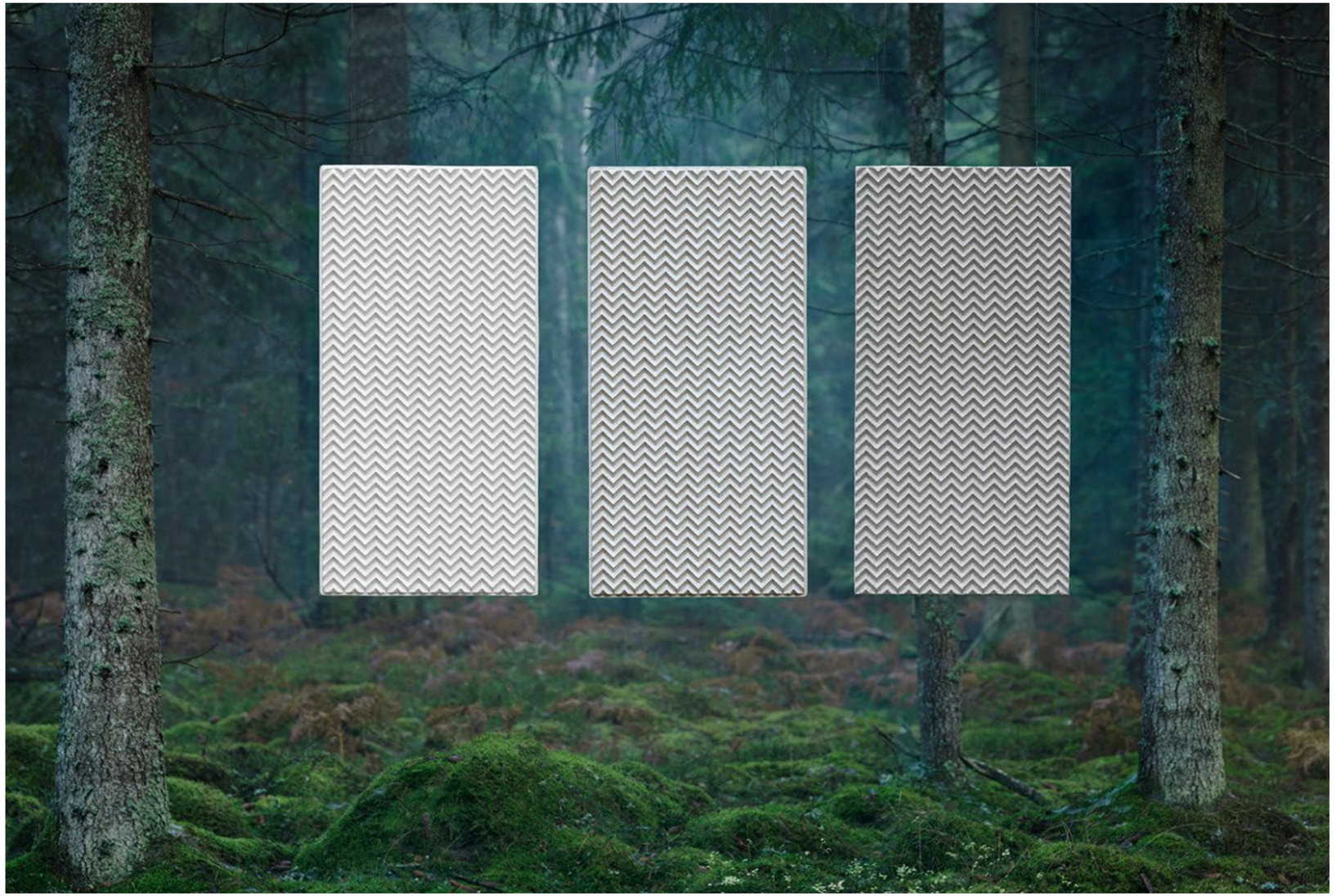
- **Origins:** 100% bio-based _ made from fish scales
- **Typology:** interior wall cladding, furniture
- **Dimensions:** 500x500x10/12/15 mm, custom dimensions on demand
- **Colours / Finishes:** 7 standard colours, custom colours on demand
- **Fire rating:** B-s2,d0 - Class 1
- **Certification:** Eurofins-Indoor Air Comfort Gold (VOC free), can be used in LEED / BREEAM / CAM projects

Notes: 100% biodegradable, 100% recyclable, can be transformed with conventional timber tools
Samples: available

Scale_Scalite tiles

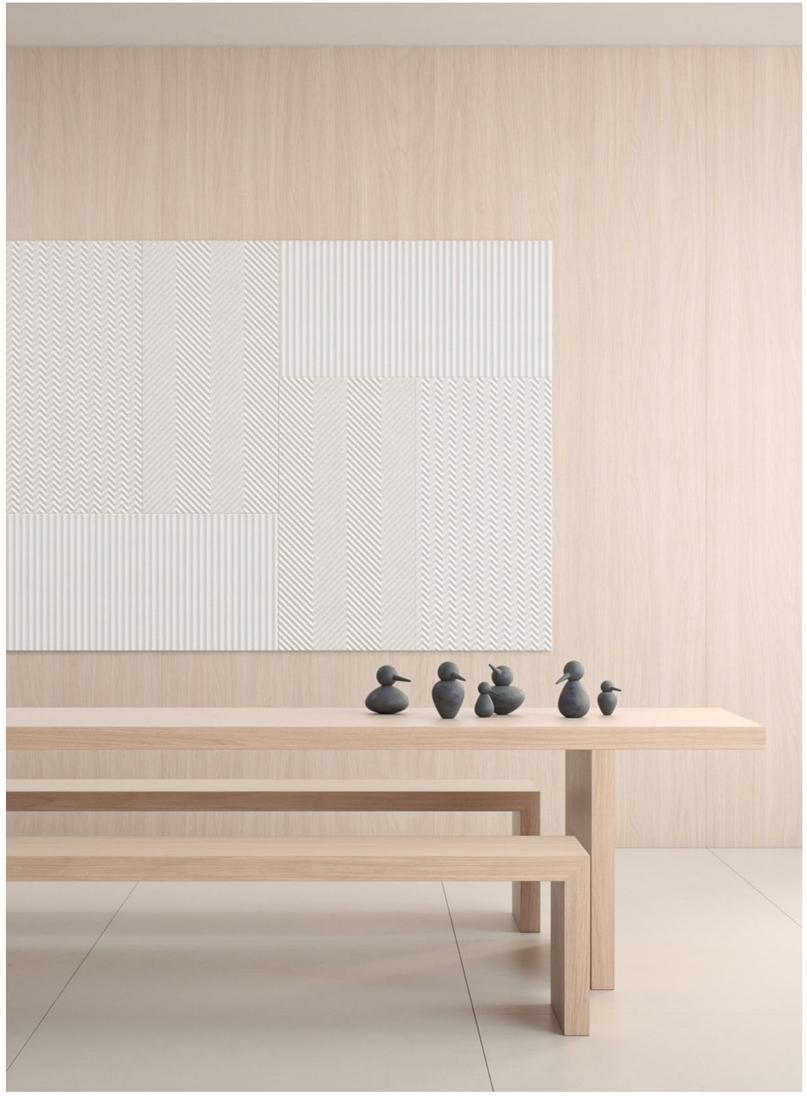
Baux_Acoustic Pulp Panels

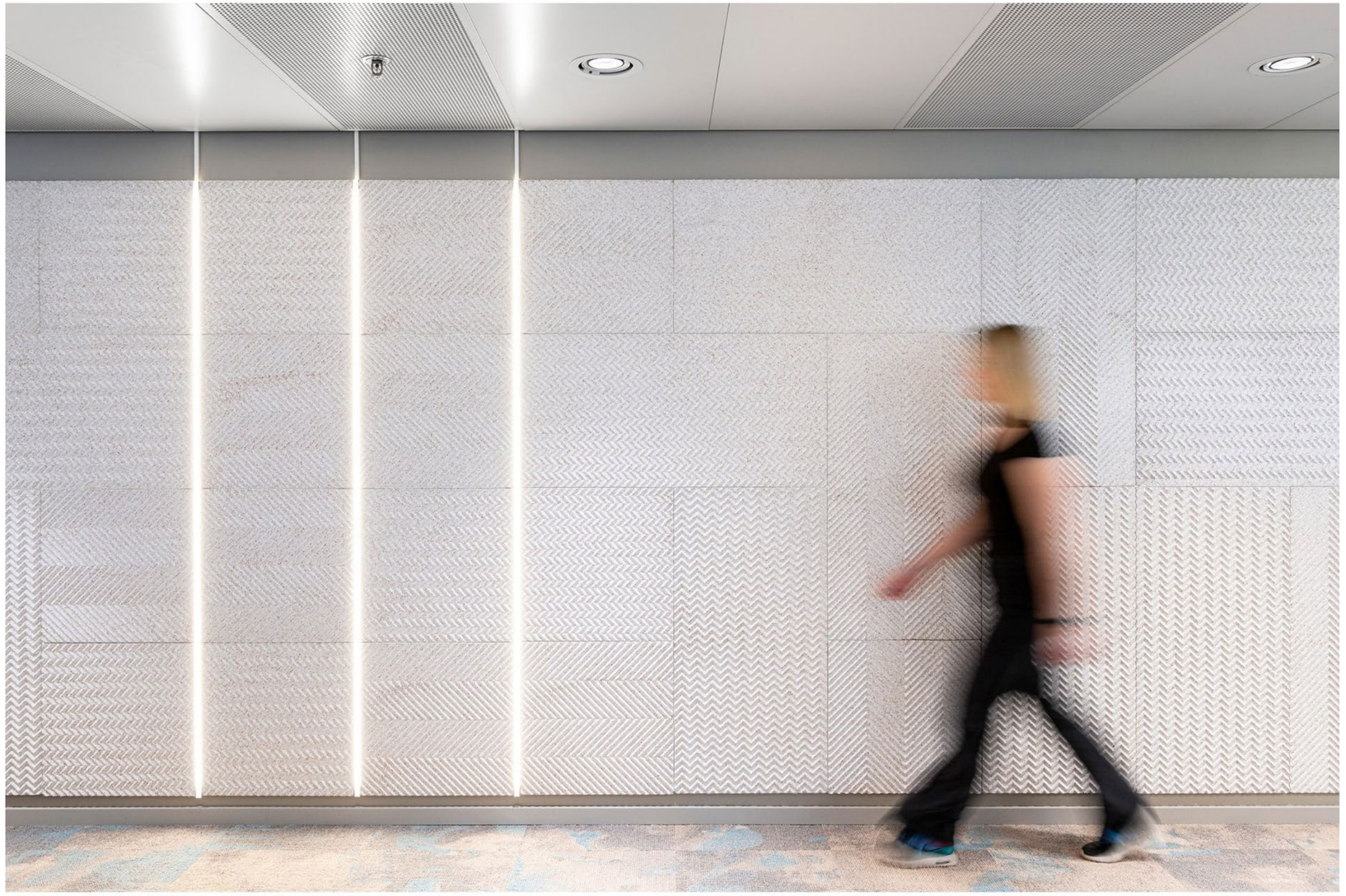
- **Origins:** 100% bio-based _ made from cellulose, wheat bran and mixture of citrus fruit peels, potato starch and wax from plants
- **Typology:** interior cladding, acoustic panels
- **Dimensions:** 500x1000x20 mm
- **Colours / Finishes:** white, available in 3 patterns (Origami Sense / Origami Pulse / Origami Energy)
- **Price list:** 270 €/6 panels with the same pattern _ 90€/sqm
- **Lead time:** 6/8 weeks
- **Fire rating:** D-s2,d0 - Class 3
- **Certification:** Eurofins-Indoor Air Comfort Gold (VOC free), can be used in LEED / BREEAM / CAM projects



Notes: 100% biodegradable, 100% recyclable, new colours being tested
Samples: available

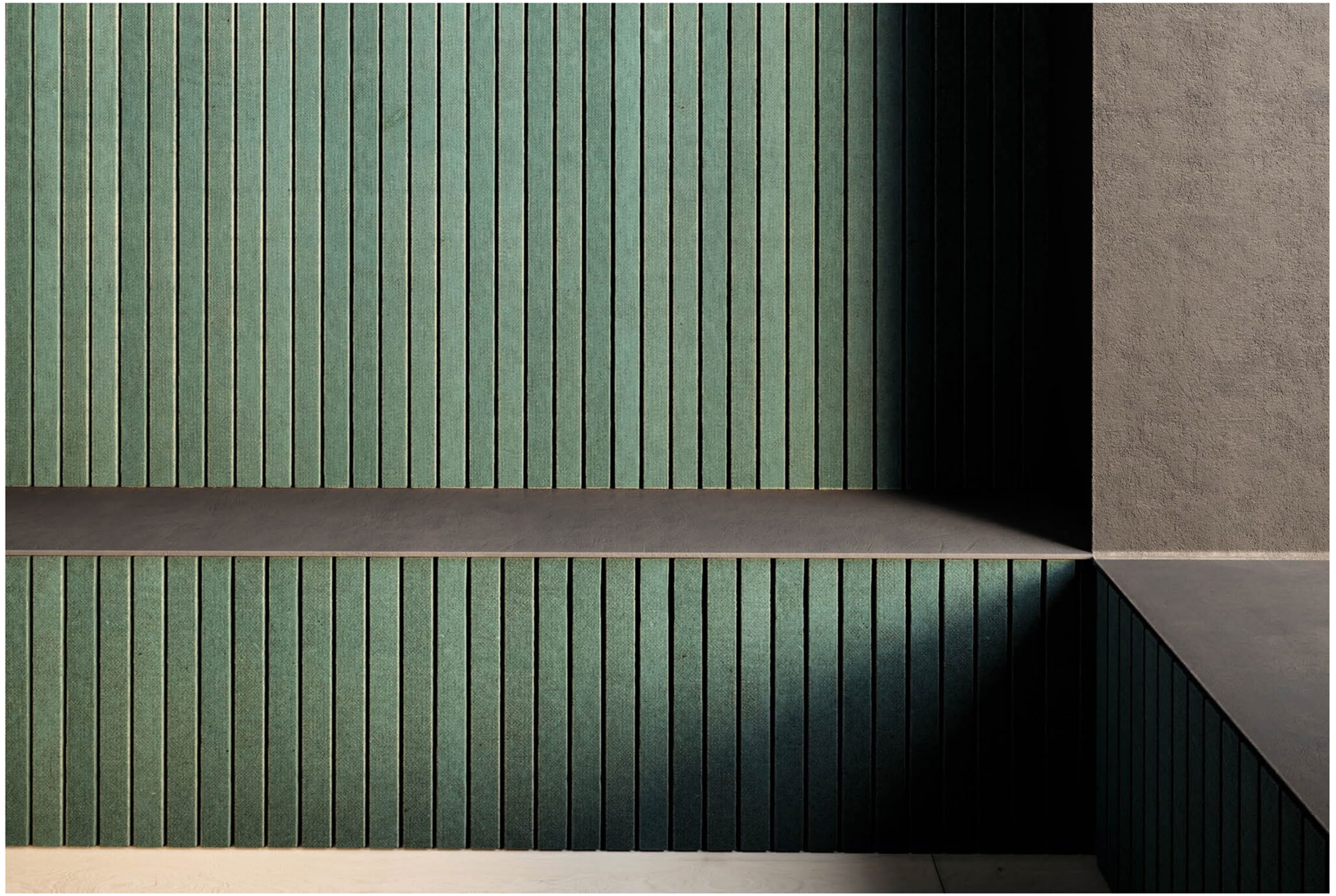
Baux_Acoustic Pulp Panels





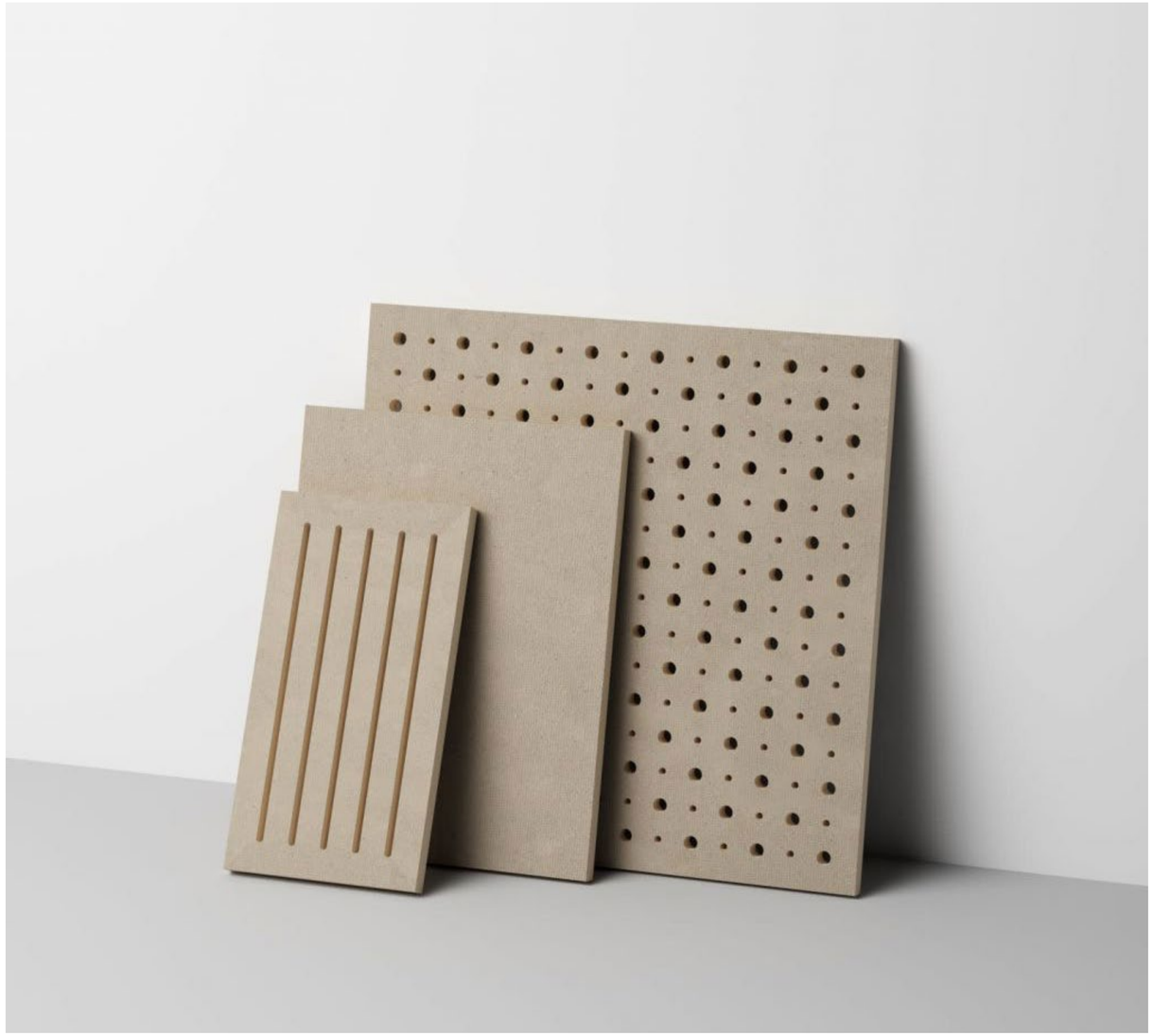
Honext_Cellulose boards

- **Origins:** 100% bio-based _ made from waste cellulose
- **Typology:** interior cladding, acoustic panels, furniture
- **Dimensions:** 2440x1220x12 mm
- **Colours / Finishes:** beige/brown, texture and/or painted on demand
- **Fire rating:** C-s1,d0 - Class 2
- **Certification:** Cradle to Cradle Silver CertifiedMaterial Health Silver Certified, Class A+ French VOC regulation (VOC free), can be used in LEED / BREEAM projects



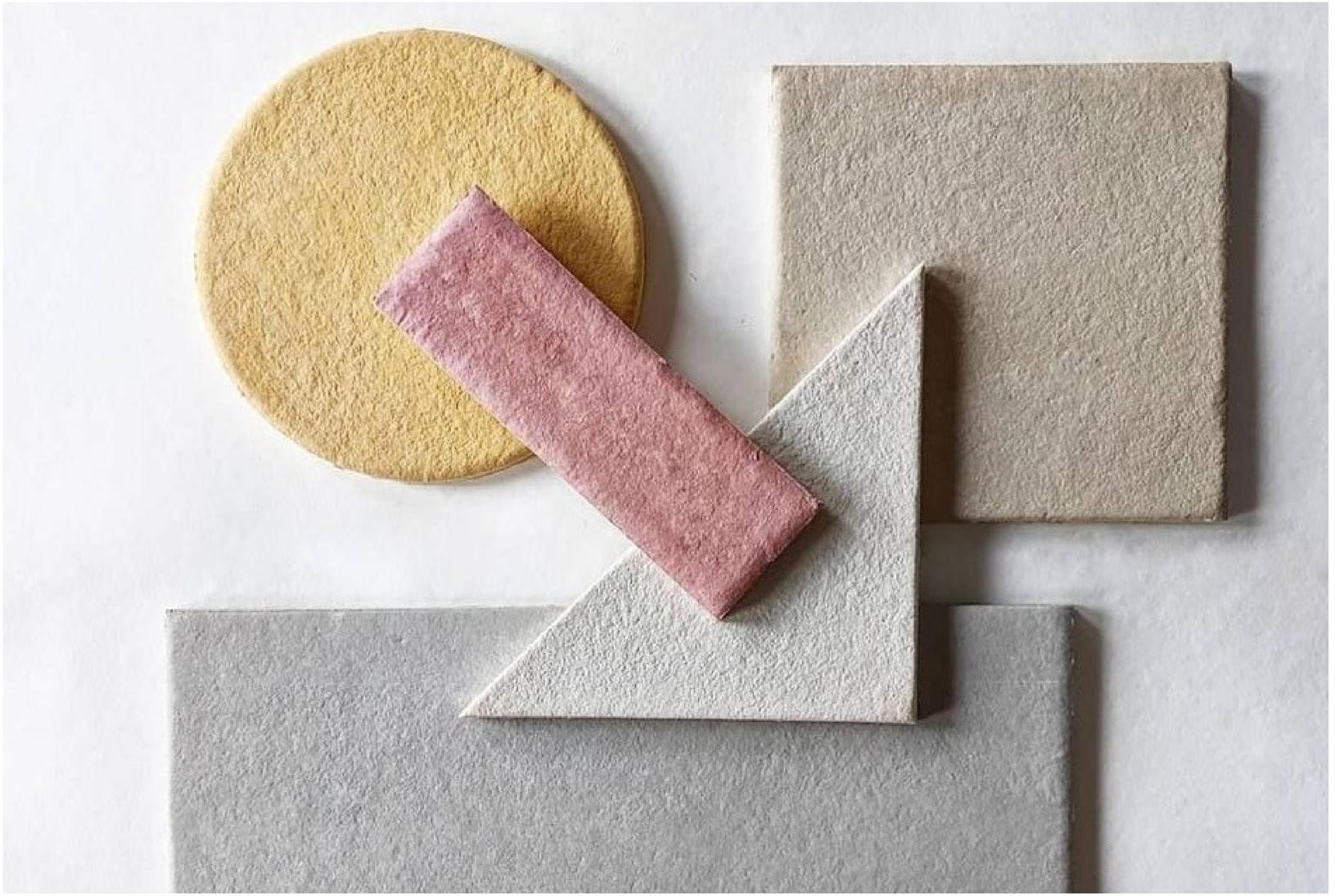
Notes: 100% recyclable, can be transformed with conventional timber tools, printable surface
Samples: available

Honext_Cellulose boards



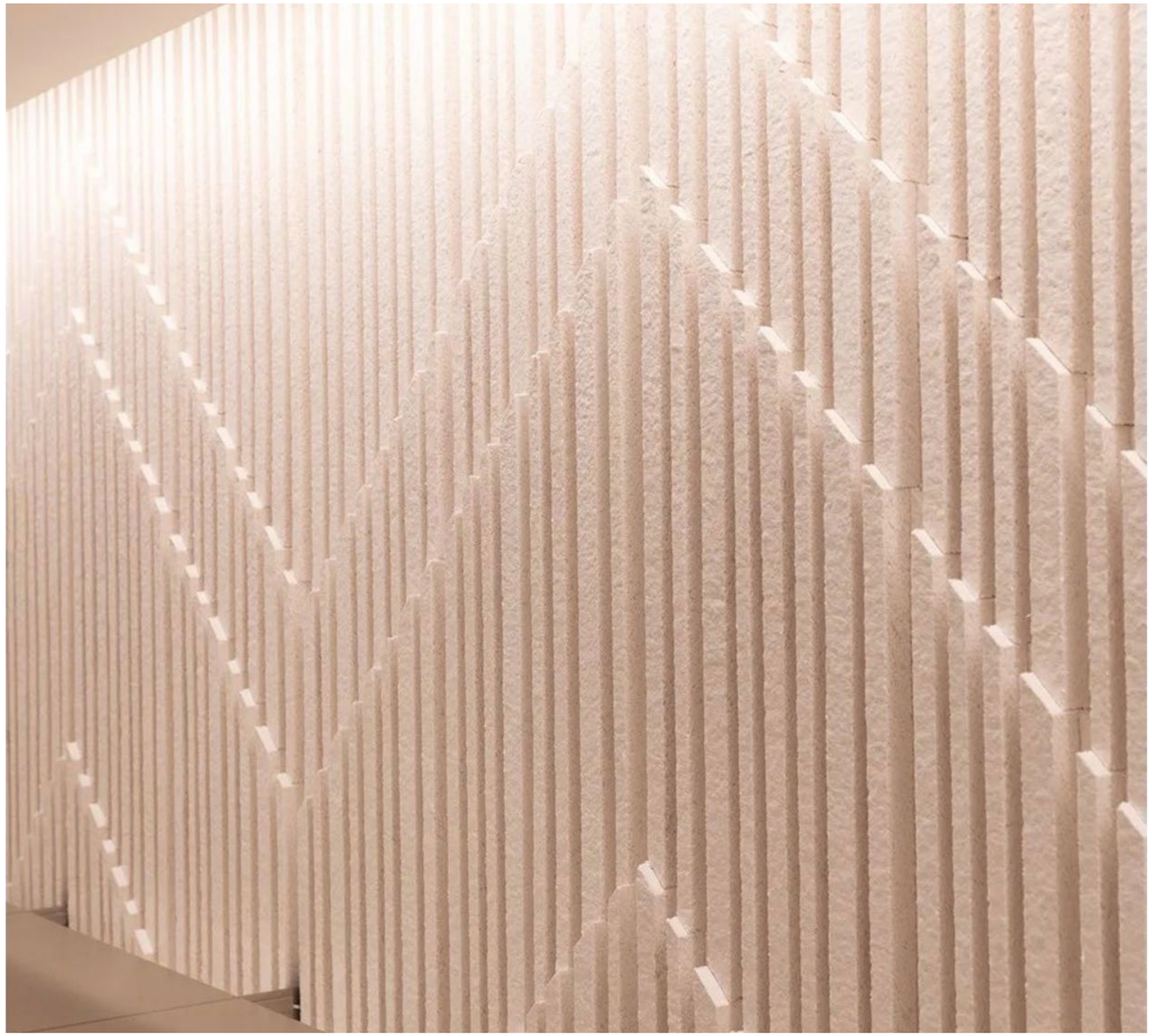
Milleforma_Cotton Acoustic Tiles

- **Origins:** 100% bio-based _ made from cotton linters and clay
- **Typology:** interior wall cladding, acoustic panels, furniture
- **Dimensions:** 12 standard sizes, custom dimensions on demand
- **Colours / Finishes:** 54 colours, texturefor some size
- **Fire rating:** B-s1,d0 - Class 1
- **Certification:** Class A+ French VOC regulation (VOC free)



Notes: 100% recyclable
Samples: available

Milleforma_Cotton Acoustic Tiles



Gwilen_Marine sediments tiles

- **Origins:** 100% bio-based _ made from marine sediments (clay, sand, salt, shell waste and algae residues)
- **Typology:** interior/exterior wall cladding, furniture
- **Dimensions:** 3 standard sizes _ Square 80x80x10 mm, Carré 160x160x10 mm, Losange 44x76x10 mm, custom dimensions on demand
- **Colours / Finishes:** 10 standard colours, each in 3 shades (natural/pastel/intens). All these shades are available in raw (without treatment), oiled or waxed version
- **Fire rating:** A1 - Class 0
- **Certification:** VOC free (certification is currently not available))

Notes: terrazzo with waste Gwilen material being tested
Samples: available

Gwilen_Marine sediments tiles

Nature Squared_CArrelé Collection

- **Origins:** 100% bio-based _ made from crushed eggshell mixed with a bio-resin
- **Typology:** interior cladding, furniture
- **Dimensions:** 5 standard sizes _ Square 100x100 mm, Rectangle 25x100 mm / 25x150 mm, Triangle 100x100 mm, Mini 35x6 mm
- **Colours / Finishes:** 6 standard colours, each with 3 different size of fragments (large/medium/small)
- **Fire rating:** C-s1,d0- Class 2
- **Certification:** VOC free (certification pending)

Notes: 100% biodegradable
Samples: available

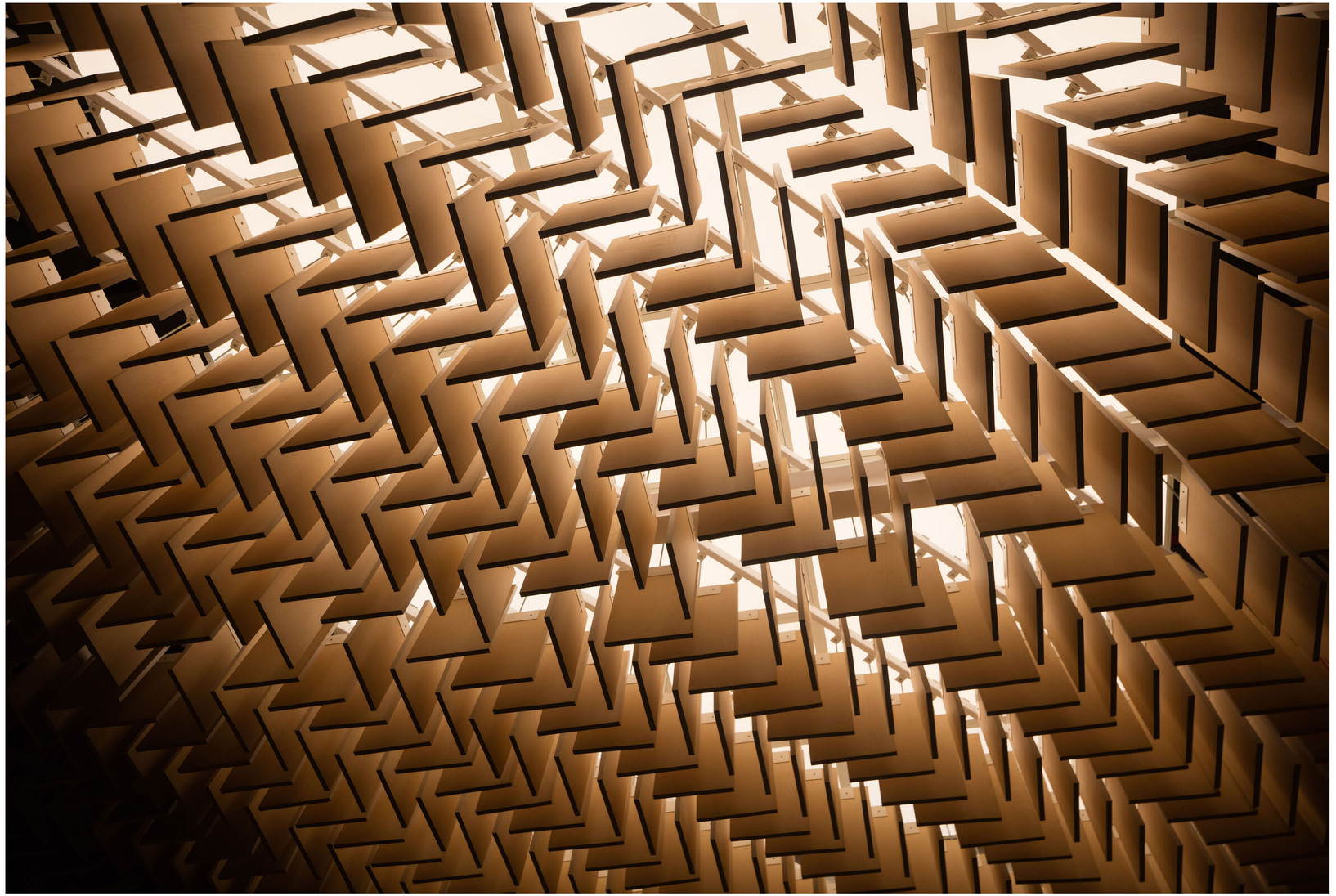
Nature Squared_CArrelé Collection

Resysta_UPB boards

- **Origins:** 60% bio-based _ made from husk rice + 40% pvc
- **Typology:** interior/exterior wall cladding, flooring, decking, furniture
- **Dimensions:** 1220x2440x6/8/12/16/20 mm, custom dimensions on demand
- **Colours / Finishes:** 30 standard colours, texture like wood, custom colours on demand
- **Fire rating:** D,s3,d0 - Class 4
- **Certification:** can be used in LEED / BREEAM projects

Notes: 100% recyclable, 100% water resistant, can be transformed with conventional timber tools, thermoformable
Samples: available

Resysta_UPB boards



Kairos_Kairlin

- **Origins:** 100% bio-based _ made from flax/hemp fibers and mixture of cornstarch, beet, sugarcane
- **Typology:** interior cladding, flooring, furniture
- **Dimensions:** 1200x2400x1/50 mm
- **Colours / Finishes:** Brown, Black, White
- **Fire rating:** E,d1 - Class 4
- **Certification:** -

Notes: 100% recyclable, 100% biodegradable, can be transformed with conventional timber tools, thermoformable, printable surface
Samples: available

Kairos_Kairlin

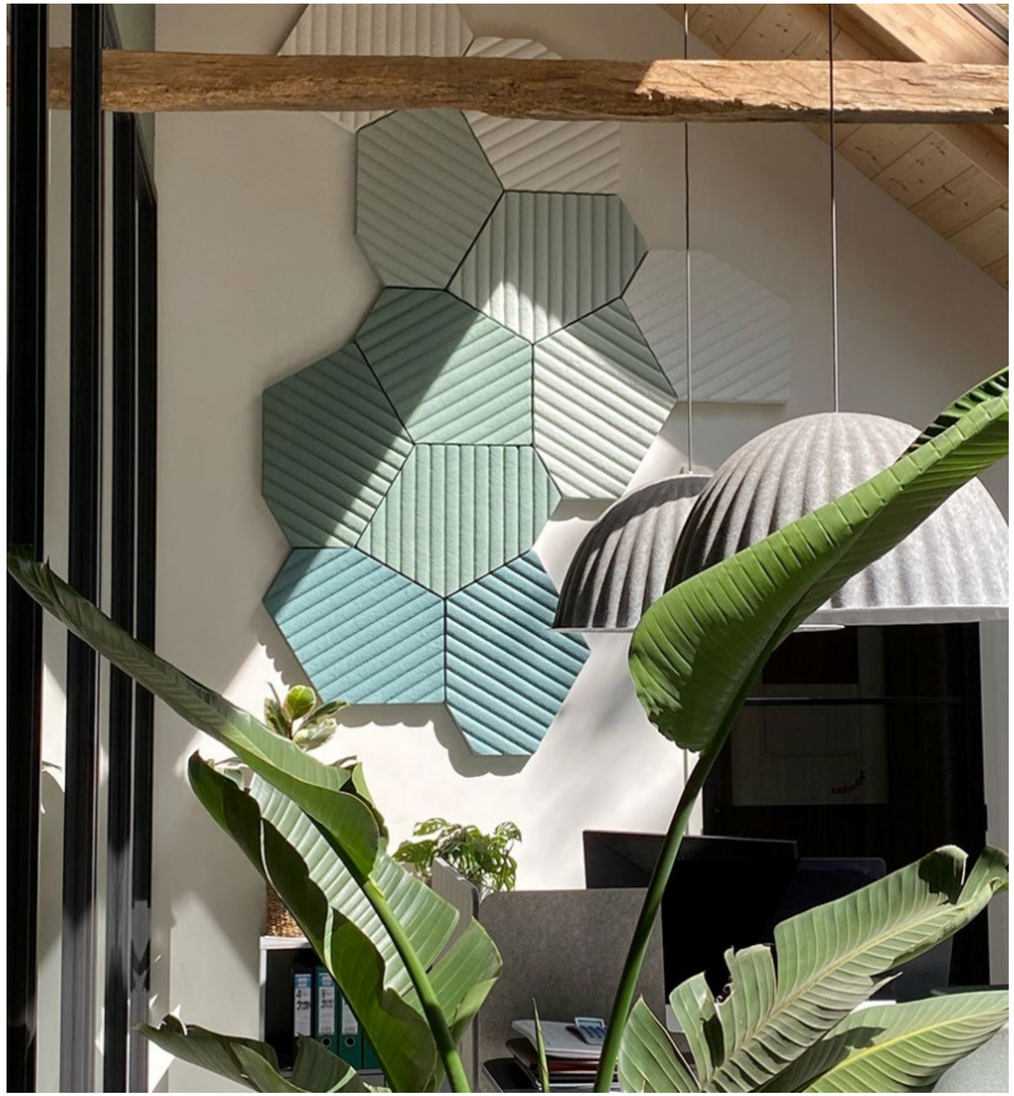
Mogu_Pluma panels

- **Origins:** 100% bio-based _ made from mycelium grown on organic fibers (low-value residues from agro-industrial value chains)
- **Typology:** interior cladding, acoustic panels
- **Dimensions:** 500x500x20 mm, 600x600x20 mm, 500x1000x20 mm, 600x1200x20 mm. Custom dimensions on demand
- **Colours / Finishes:** 21 standard colours, 4 texture, custom colours and texture on demand
- **Fire rating:** B-s2,d0 - Class 1
- **Certification:** Eurofins-Indoor Air Comfort Gold (VOC free), can be used in LEED / BREEAM projects

Notes: 100% biodegradable, the material is recyclable as a new mycelium nutrient
Samples: available

Mogu_Acoustic panels

- **Origins:** 100% bio-based _ made from mycelium grown on organic fibers (low-value residues from agro-industrial value chains)
- **Typology:** interior cladding, acoustic panels
- **Dimensions:** 7 standard sizes_ Wave 560x505x25/70 mm, Kite 500x500x35-75 mm, Plain 500x500x40 mm, Plain 600x600x40 mm, Plain 600x400x40 mm, Fields 760x535x50 mm, Foresta 465x400x65 mm. Custom dimensions on demand
- **Colours / Finishes:** 21 standard colours, different texture according to the size, custom colours on demand
- **Fire rating:** B-s2,d0 - Class 1
- **Certification:** Eurofins-Indoor Air Comfort Gold (VOC free), can be used in LEED / BREEAM projects



Notes: 100% biodegradable, the material is recyclable as a new mycelium nutrient
Samples: available

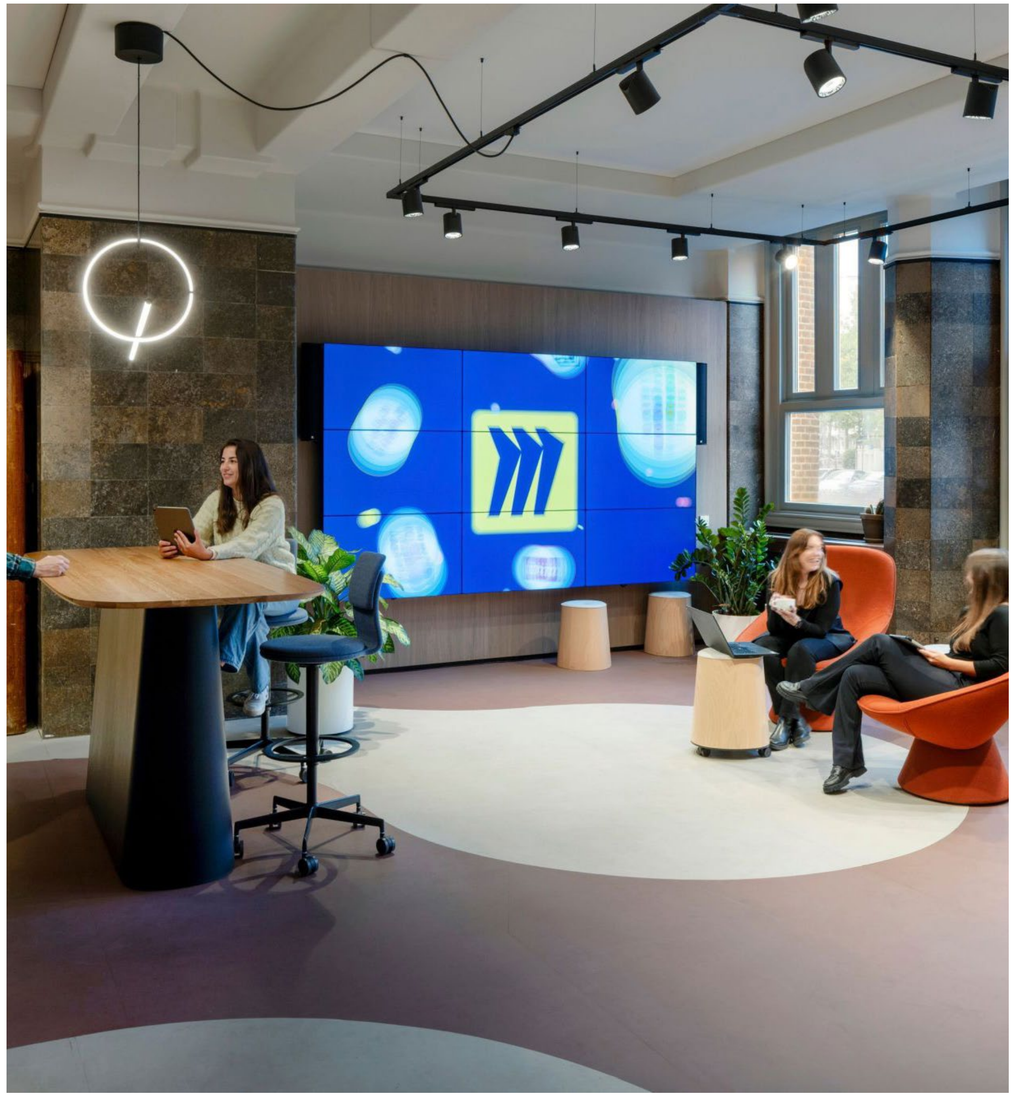
Mogu_Floor tiles

- **Origins:** Aesthetic layer _ 68% bio-based polyurethane with oyster shells + 2% water-based paint + 30% recycled PET. Core layer _ 100% bio-based high density fiberboard derived from the fiber waste of the textile industry and a natural binder
- **Typology:** flooring
- **Dimensions:** 2 standard sizes_ Square M 500x500x7 mm, Plank: 250x500x7 mm. Custom dimensions on demand
- **Colours / Finishes:** 21 standard colours, custom colours on demand
- **Fire rating:** Cfl-s1 - Class 1
- **Certification:** Eurofins-Indoor Air Comfort Gold (VOC free), can be used in LEED / BREEAM projects

Notes: The core layer is biodegradable. The Aesthetic layer can be ground and recycled up to 50% in a new production. Recycled PET is shredded (as well as installation glue residues) and does not affect the recycling process.
Samples: available

Mogu_Floor flex

- **Origins:** 68% bio-based polyurethane with oyster shells + 2% water-based paint + 30% recycled PET
- **Typology:** flooring
- **Dimensions:** 4 standard sizes _ Square S 500x500x1,5/2,5 mm, Square M 700x700x1,5/2,5 mm, Square M 1000x1000x1,5/2,5 mm, Slab 1000x200x1,5/2,5 mm. Also available in rolls 20 m x 1400 mm
- **Colours / Finishes:** 21 standard colours, custom colours on demand
- **Fire rating:** Cfl-s1 - Class 1
- **Certification:** Eurofins-Indoor Air Comfort Gold (VOC free), can be used in LEED / BREEAM projects



Notes: The material can be ground and recycled up to 50% in a new production. Recycled PET is shredded (as well as installation glue residues) and does not affect the recycling process
Samples: available

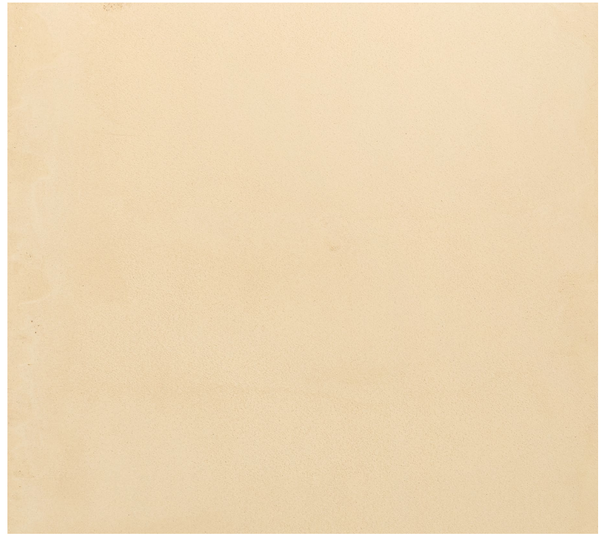
Rice House_RH 120

- **Origins:** Natural plaster mixture of lime and rice husk
- **Typology:** finishing plaster
- **Dimensions:** -
- **Colours / Finishes:** white
- **Fire rating:** A2 - Class 1
- **Certification:** can be used in LEED / CAM projects

Notes: contributes to the reduction of indoor pollution, as the rice husk is able to absorb CO2 from the air present inside the building
Samples: available

Rice House_RH410 / RH420

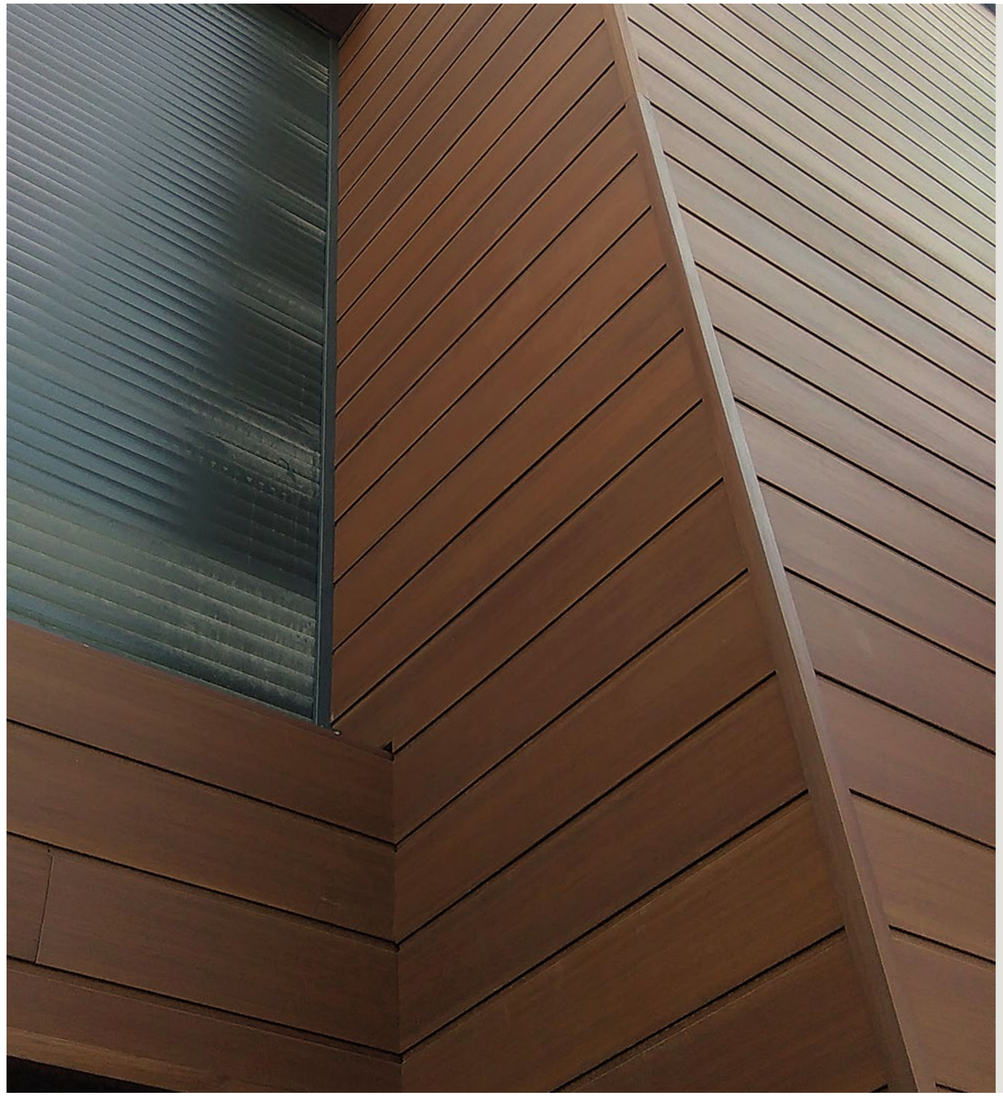
- **Origins:** Natural finishing plaster mixture made from clay, natural hydraulic lime and natural-ly colored rice husk in mass.
- **Typology:** finishing plaster
- **Dimensions:** -
- **Colours / Finishes:** 8 standard colours7
- **Fire rating:** A1 - Class 0
- **Certification:** can be used in LEED / CAM projects



Notes: contributes to the reduction of indoor pollution, as the rice husk is able to absorb CO2 from the air present inside the building
Samples: available

Rice House_RH-DECK / RH-FACE

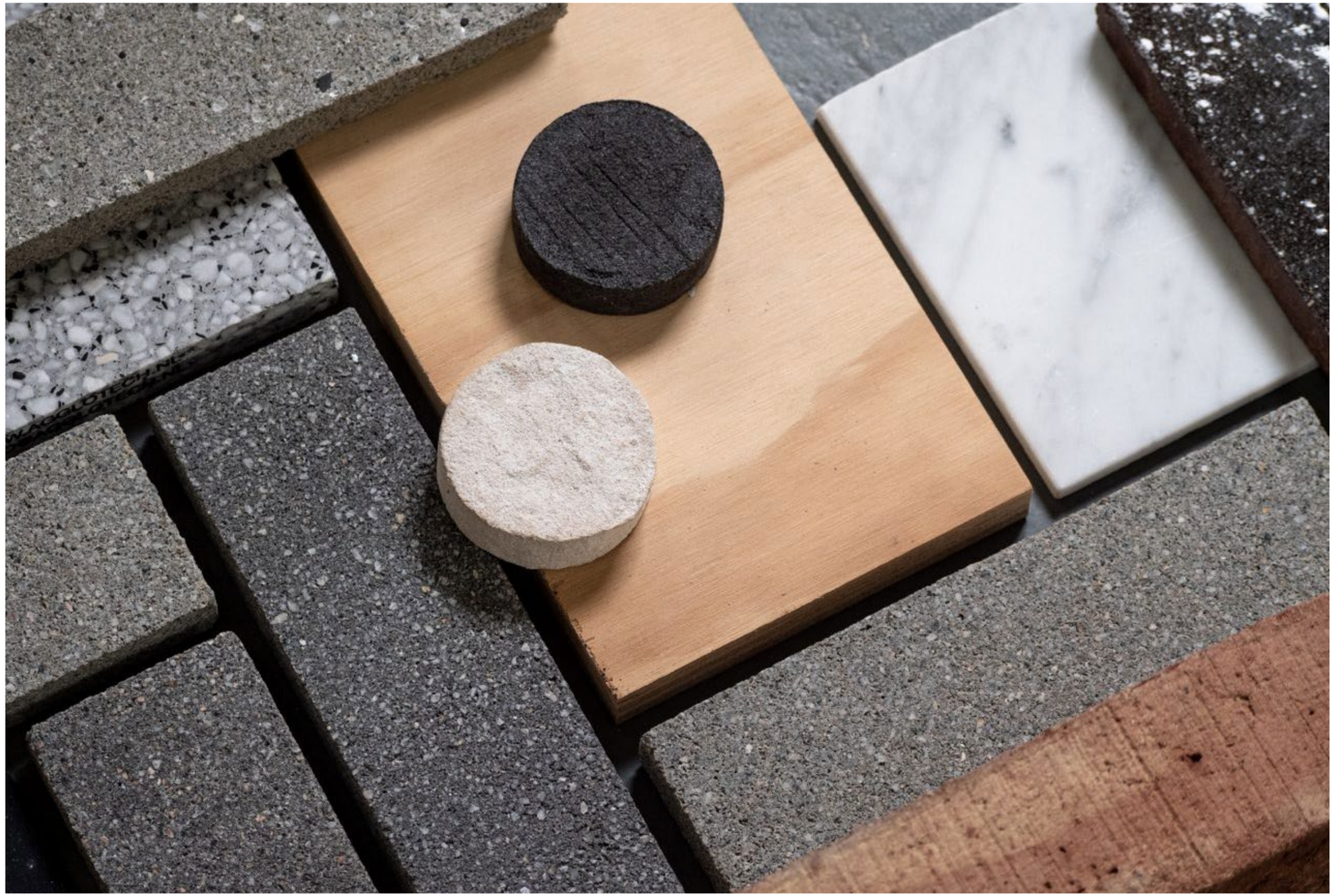
- **Origins:** 60% bio-based _ made from husk rice + 40% pvc
- **Typology:** interior cladding, flooring, decking
- **Dimensions:** RH-DECK _ 2400/3000/6000 x124x21 mm, RH-FACE _ 3000/6000x 130/173/330x13 mm
- **Colours / Finishes:** 4 standard colours, 3 finishes (honed,scratched, brushed)
- **Fire rating:** D,s3,d0 - Class 4 (C,s2,d0 - Class 3 with additives)
- **Certification:** can be used in LEED / CAM projects



Notes: 100% recyclable, 100% water resistant, can be transformed with conventional timber tools, thermoformable
Samples: available

StoneCycling_BioBasedTile

- **Origins:** 15% Biocement (calcium carbonate biologically generated) + 85% industrial waste aggregate
- **Typology:** interior/ exterior cladding, flooring
- **Dimensions:** 225x19x52 mm, 400x19x40/200 mm, 600x10x300/600 mm
- **Colours / Finishes:** 2 standard colours (Salt, Pepper) e 2 standard finishing (Honed, Polished)
- **Fire rating:** A1 - Class 0
- **Certification: c**an be used in LEED / BREEAM / WELL projects



Notes: 95% less CO_2 emission than traditional cement
Samples: available

StoneCycling_BioBasedTile

Sofalca_Gencork

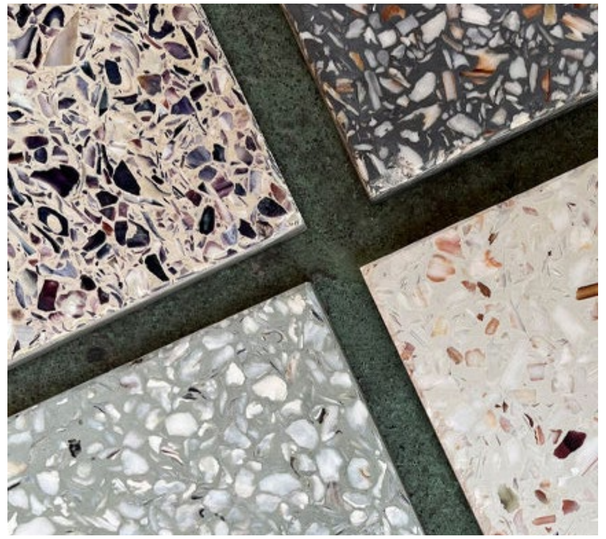
- **Origins:** 100% bio-based _ made from cork
- **Typology:** interior wall cladding, acoustic panels, furniture
- **Dimensions:** 1000x500x20/30/100 mm
- **Colours / Finishes:** brown, 20 different textures
- **Fire rating:** E,d1 - Class 4
- **Certification:** Class A+ French VOC regulation (VOC free)

Notes: 100% recyclable, water and weather resistant, contributes to the reduction of indoor pollution, as the cork is able to absorb CO2 from the air present inside the building
Samples: available

Ostrea Design_Terrazzo Marin

- **Origins:** 100% bio-based _ made from discarded seashells
- **Typology:** interior wall cladding, furniture
- **Dimensions:** 3 standard sizes, 185x95x20 mm, 125x135x20 mm, 294x132x20 mm
- **Colours / Finishes:** 4 standard colours, 3 texture each with 3 different size of fragments (large/medium/small), custom colours on demand
- **Fire rating:** A2-s1,d0, Class 1
- **Certification:** -

Notes: 100% recyclable, can be transformed with conventional timber tools
Samples: pending



04 Park application

01_Darkness and Light

- Location: Milan, Italy
- Architect: PARK ASSOCIATI
- Year: 2021

A theatre's dressing room is a place that absorbs and reflects. It absorbs an actor's concentration and tension before going on stage, it witnesses the metamorphosis created by make-up and dressing and it welcomes confidences, quips, anxiety and liberation. This environment can offer different sensations thanks to the varied treatment of its surfaces. The black colour accentuates the need to concentrate, the soft, comfortable floor is ideal for walking barefoot. The wall is covered with small sound-absorbing panels that create a texture, absorb sounds and interact with the mineral qualities of the painted walls. The metallic sheen of the false ceiling and the curtains' weave contrasts and completes the range of materials.

The light fixtures soften the darkness, welcoming after-show guests and comments – a reminder of theatre's ancient popular origins. The dressing room acts as a border line between reality and enactment, the beginning and the end of a hero's journey, darkness and light. This intimate and somewhat enchanted place was created with the collaboration of major Italian design companies and newer artisanal companies. The perfectly harmonised team work was experienced as the rehearsal of an orchestra or an ensemble which, thanks to the contribution of each member, eventually manages to find the right register and harmony.

01_Darkness and Light

01_Darkness and Light

The construction sector is striving to become more sustainable in response to the climate crisis, and the bio-based use of materials has played a significant role in this effort. While achieving net-zero architecture is a complex task, there is a clear shift in culture and thinking, driven by innovation, that is leading the way towards a more sustainable future.

Futher reading:

- Bioarchitecture: bioinspired art and architecture—a perspective
- ‘If you win the popular imagination, you change the game’: why we need new stories on climate
- Why the construction industry needs its own vegan diet
- Allevamenti intensivi. Così in Italia macelliamo anche le risorse naturali
- Our Climate Change & Biodiversity Strategy Circular Design
- “There are a lot of dangerous myths” about sustainability says Norman Foster
- Martin Rauch, Boltshauser Architekten Rauch residential house
- #165 Flagship store
- What Are Biomaterials in Architecture?
- The Dezeen guide to bio-based materials in architecture, design and interiors
- Circularity and Biobased Materials in Architecture and Design

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