



ACTAsia-The researcher Team 1

A report on **plant based materials**

Islay DUNLOP, MA Fashion cultures

Shuyu Jiang, MA Fashion Artefact

Yun-Yen LO, MA Fashion Retailing

Zongyuan Wang, MA Fashion Artefact

CONTENT

4 Introduction

5 The purpose

6 China's Fur Market

8 Recommendation

10 Development

12 10 Materials

14 Research results

16 Graphic table

18 Illustration

20 Conclusion

22 References

01 Introduction

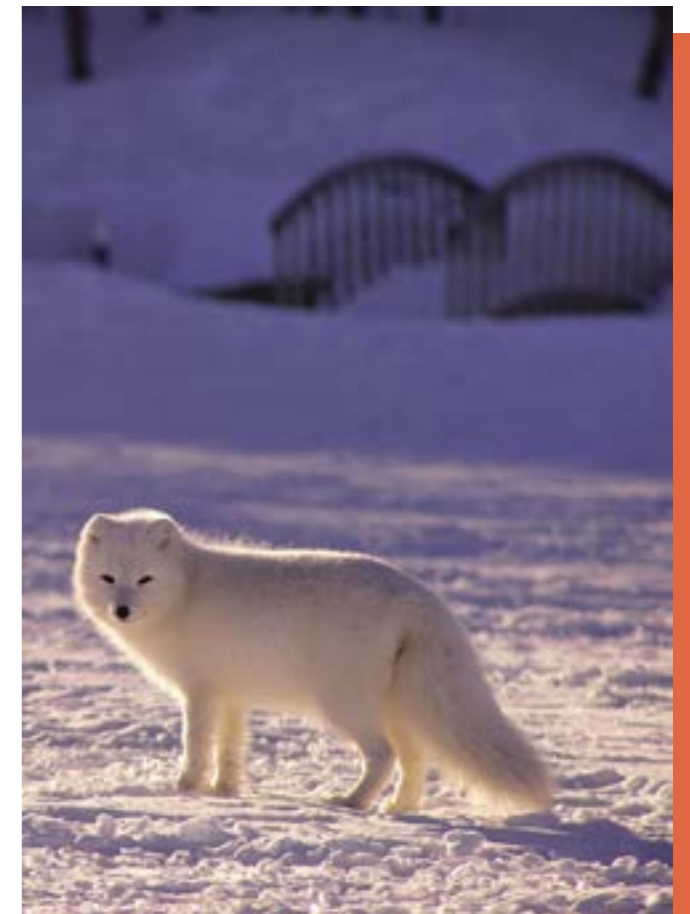
- The Purpose
- China's Fur Market
- Recommendations

T H E P U R P O S E

ACTAsia aims to help Asian cultures evolve into caring societies, promoting kindness, compassion and responsibility for all forms of life in order to rich content to educate and change in Asian societies. As we may notice that, consumers now seriously considerably the environment impact of products because of the evolution environmental awareness. As well as Chinese government also acknowledges that innovative, coordinated, green and shared development which can be essential for China's overall progress.

In a nutshell, ACTAsia would like to have the research and evidence collected on ten vegan plant based alternative materials on environmental sustainability, throughout the process from plant to product and afterlife, considering environmental, human and animal impacts. In other words, making by alternative fur and vegan materials is a new and upcoming area.

It is also a great start point to figure out new materials which have been processed so they are more like to have a deeper level of understanding of the production processes and chance to become mass production and benefit our society and environment among the next generation.



China's Fur Market

Based on ACTAsia's recent research point out that China is one of the major fur-producing countries and has now become one of the biggest fur-consuming countries in the world, and the numbers are growing.

This pressure has prompted growth in the materials science space, with Gucci-owner Kering, Hermès, Allbirds and more announcing partnerships with companies promising the next generation of sustainable materials.



Most fur sold globally is from farmed animals, with common examples being mink, fox, raccoon dog, rabbit and chinchilla. Millions of animals raised for fur endure tragic lives such as miserable lives in small, wire mesh battery cages and horrifying deaths. Nonetheless, the fur industry is keen to forge links with fashion. The production of fur for fashion can impose significant adverse impacts on both environment and human health, and consumers should be made aware of this.



Much of this chatter has been focused around leather alternatives, however, as more brands move away from fur, companies may capitalise on demand in the market for options, bio-based or other. Since ACTAsia is running the Fur Free China campaigns many years including breeding, animal capture, containment, slaughter and environmentally damaging production processes. In order to encourages the Chinese public, both the public and government should be aware of this issue. Not only external factors as pervious mentioned but take more awareness to compassionate lifestyle choice and join a fur free life.

As a result, nowadays many fashion brands which under increasing pressure to reach environmental targets and appeal to sustainability-minded consumers, are moving away from animal-based materials, such as exotic skins and fur.



Recommendations

This report is intended as a functional guide that is easy to read and straightforward for designers, brands but also for consumers. It is fundamental at this stage that also consumers have the knowledge to know what to buy or at least to have the awareness of what they are buying. The information and data gathered is useful to create a narrative behind materials that can make a difference in the fashion industry but that at the same time can be used for other industries; the exchange between materials used for products that are not strictly from garment production is fundamental to achieve a more sustainable and inclusive future for everyone, human, animals and environment.

DEVELOPMENT

- 10 Materials
- Research Results
- Graphic table

10 Materials



● **Mycelium**
A branching filamentous structure used by mushrooms to grow. Make it into a new kind of leather.



● **Nuo and Ligneah**
As soft as leather and as smooth as fabric which made of real wood, vegan and sustainable. It is surprisingly light and looks very luxurious, can be bent in all directions and is very soft.



● **Piñatex**
Piñatex is an innovative non-woven textile made from waste pineapple leaves, a waste product of the major pineapple farming industry in the Philippines.



● **Leap™**
Leap™ is a plant-based leather alternative with every quality of traditional leather but more beautiful.



● **Orange Peel**
Abandoned healthy orange peels.



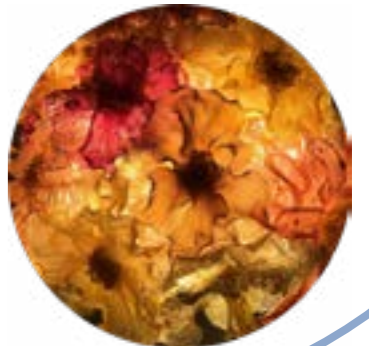
● **Tomtex**
A leather alternative made from shell seafood waste and coffee ground waste that can be embossed with a variety of patterns to replicate animal leathers.



● **Soybean Protein Fiber**
A plant based fabric obtained by the isolation of the protein of soybeans. It possesses properties similar to synthetic fibres like moisture absorption and easy and fast wash. Other properties include soft and shiny feel and easiness in dyeing the fabric.



● **Tree Leaf**
Use true leaves combine with leather or fibre.



● **Agar**
An ingredient commonly found in Asian cuisine, especially desserts, is a high-strength gel mainly extracted from two types of red seaweed.



● **Wineleather**
Wineleather is a plant based leather obtained by the waste of wine production. easiness in dyeing the fabric.



Research results

The research tackled 10 plant-based materials that thanks to their outstanding properties will be - and are able - to substitute some of the most polluting, toxic and unkind materials that compose most garments' fabrics. Starting from materials obtained by repurposing organic waste from wine production that produces a leather-like fabric; to materials that become bioplastic, that are plastic-like plant-based materials that carry similar properties to plastic but are mostly made of water so the recyclability and compostability are very easy to obtain. So, trying to find different kinds of materials that would fill the gap of the substitution of the old, dated and destructive ones, these are the plant-based for the future market: Agar, Apple Leap, Mycelium, Nuo/Ligneah, Orange Peel, Pineapple Leap, Soybean Protein Fibre, Tomtex, Tree Leaf

and Wineleather. The final research showed how most of these materials have a similar cost to one another, so the competitiveness lays on the properties, social and environmental impact. The most expensive materials were actually Wineleather, that has been used for cars' interiors but also as a vegan leather option for clothing and accessories; the second most expensive material is Nuo/Ligneah, a material obtained by wood fibres that is smooth like fabric but soft at touch like leather. Other materials like Agar, still have to be experimented in fabric and textile production so cost range is still difficult to count, but it has properties like the fact that it imitates the plastic look and feel without risking to endanger sea-life nor pollute during production, that possesses great perspectives. The chart compares the 10 different

materials from different points of view; firstly what it is and where it comes from, then production which is essential to understand the process that gives life to the new or repurposed material; it was important also to include if the fabric had already used in other circumstances; after this the cost is fundamental to understand if it's economically sustainable to invest in; obviously the waste during production is important to consider; and finally afterlife, to understand what are the environmental consequences after the fashion garment has been thrown away is one of the biggest concerns that should come to mind before producing or buying a garment.

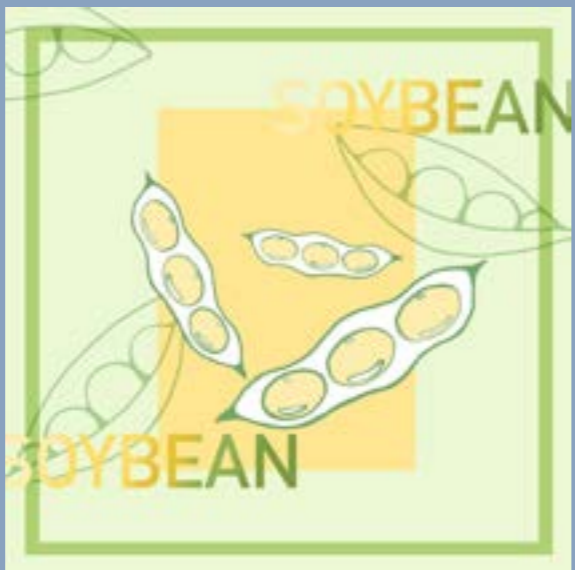
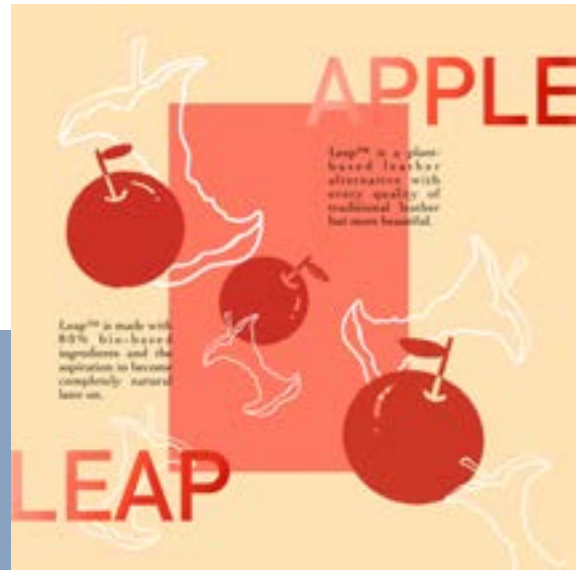


Graphic table

	What it is	Production	Already in use for	Cost	Waste	Afterlife
Agar	An ingredient commonly found in Asian cuisine, especially desserts, is a high-strength gel mainly extracted from two types of red seaweed. Agar for its highly moldable and biodegradable features. A gelatinous colloidal extract of a red algae As of the genera Gelidium, Gracilaria and Eucheuma used especially in bacteriological culture media or as gelling and stabilizing agent in food.	Agar + Glycerin + Water = Bioplastic It can be used different kinds of materials to mix with agar such as agar+wool, soap	It is a thermo-softening polymer, making things with agar is always reversible and zero-waste. From interior furnishings to fashion accessories.	The material created by comprises of agar, food waste and 3D printed moulds which can weave and braid together to form beautiful bio-degradable flowers and pieces in organic colours and textures.	Zero waste	100% biodegradable
Apple Leap	Leap™ is a plant-based leather alternative with every quality of traditional leather but more beautiful.	Leap™ is made with 80% bio-based ingredients and the aspiration to become completely natural later on. The 3-layered structure is designed to be disassembled at the end of life which makes Leap™ a truly sustainable material.	Bags	60x60 cm prototyping sheet € 150,00 EUR	It takes only 1 day to create Leap™ using 99% less water and ~85% less CO2* than traditional leather production while completely avoiding harmful substances.	2021:Leap™ enters the Fashion market, designed for disassembly and recyclability. 2022:Leap™ is available across industries in a wide variety of colors and textures. 2023:Leap™ has a 99% bio-based coating as a top layer. 2024:Leap™ is 100% biodegradeable and leaves no trace behind.
Mycelium	A branching filamentous structure used by mushrooms to grow. Make it into a new kind of leather.	Use scaffolding and agriculture waste to purification. Then combine with fungal spores. Add the right proportion of CO2, temperature, air flow and humidity to the molding. Then it could be cut and dye.	New leather, fashion clothes, footwear, yoga product, bags	not sure	The mycelium is grown in less than two weeks using just mulch, air, and water in a vertical agriculture facility that is 100% powered by renewable energy. It is then harvested and processed into material form using Green Chemistry principles. This highly efficient process is rigorously designed to reduce environmental impact from start to finish.	Renewable, reusable
Nuo and Ligneah	As soft as leather and as smooth as fabric which made of real wood, vegan and sustainable. It is surprisingly light and looks very luxurious, can be bent in all directions and is very soft.	1. comes exclusively from sustainable forestry. 2. Being brought to the veneer mill and stored. 3. Logs are being cross-cut, debarked and steamed 4. Finally processed into high-quality veneers. 5. From single veneer leaves they produce veneer sheets in 2.5x1.25m 6. The spliced veneer sheet is glued to a fabric on its back and the wood surface is then being lasered	shoes, handbags and accessories, and launches now world-wide on the market.	250cm x 124cm € 310,00-390,00 EUR	The processed wood comes exclusively from sustainable forestry which is managed ethically and with respect for the whole ecosystem. This also means that the origin of wood can be traced at any time. NUO is environmentally friendly and 100% animal free. NUO reduces the kg CO ² emitted into the atmosphere by about 60% compared to a square meter of leather.	not sure
Orange Peel	Abandoned healthy orange peels	After orange peel is dry, ground into powder, add biological polymer plant starch base, reoccupy 3D printing technology undertakes model to this kind of mixed material, at the same time this kind of material still can have the faint scent of orange peel. There is no waste in the process and it is recyclable.	lamp, kitchen utensils, 3D print	€ 60.00-125.00 EUR	Zero waste	At the same time this kind of material still can have the faint scent of orange peel. There is no waste in the process and it is recyclable.

	What it is	Production	Already in use for	Cost	Waste	Afterlife
Pineapple Leap	Piñatex is an innovative non-woven textile made from waste pineapple leaves, a waste product of the major pineapple farming industry in the Philippines.	Leaf collection Fiber extraction Washing & drying Purification Pinafelt (a non-woven mesh that forms the base of Pinatex.) Finishing Pinatex End product	Footwear , bags & accessories, fashion, furnishing	1 linear metre (1 metre x 1.55 metres) €35.00-€58.00 Piñatex Original - €50 per linear metre Piñatex Original Pluma – €45 per linear metre Piñatex Mineral – €55 per linear metre Piñatex Metallic – €58 per linear metre Piñatex Performance – €35 per linear metre	No additional environmental resources required for raw material. No chemicals on the Cradle2cradle list of banned substances used in production. Closed loop production – residual leaf biomass is used as natural fertilizer/biofuel. Non-woven mesh is biodegradable. The base of Piñatex Performance is biodegradable, which represents 58% of the total composition.	Piñatex has been used by over 1000 brands worldwide including Hugo Boss, H&M and the Hilton Hotel Bankside.
Soybean Protein Fiber	A plant based fabric obtained by the isolation of the protein of soybeans. It possesses properties similar to synthetic fibres like moisture absorption and easy and fast wash. Other properties include soft and shiny feel and easiness in dyeing the fabric. Certifications: USDA, GOTS, ECOC, OEKO TEX	Biggest producer is China, competitors are Brazil and USA Production method: . The protein is isolated from the soybean and broken down . Extrusion the result through spinnerets. . The fibres are dried and cooled down . Chemicals like Formaldehyde or Polycarboxylic acid are used to increase durability . Spinning . The yarns are woven creating the fabric.	Underwear Bed sheets Sportswear Towels	Low depending on brand from 20€ to 100€	Production waste is fed to animals	Recyclable and compostable if natural dyes were used
Tomtex	A leather alternative made from shell seafood waste and coffee ground waste that can be embossed with a variety of patterns to replicate animal leathers.	Waste generating break down into raw materials mixing all the ingredients pouring into the mould air-dried for 2 days	bags & accessories, fashion	low	carbon footprint(per Kg) 3.1kg of shrimp shells for 1 kg Chitosan 1kg Chitosan for 48 square foot. 1.64kg CO2e/m2 Water consumption 250L/Kg 31L/Shoes	It also can be customised to be either leather-like, rubber-like or plastic-like by adjusting the formula and the way of production. So the possible applications go beyond fashion to packaging, interior or industrial design.
Tree Leaf	Use true leaves combine with leather or fibre.	1. Sustainably harvested Teak leaves are collected from fallen leaves. No trees are harmed in the process 2. The leaves are soaked in water, dyed, then arranged flat together and set out to dry, which bonds the leaves and provides a large sheet of the leaf material. 3. The leaf layer is mended with cotton fabric to provide a soft interior backing and structure. 4. A thin translucent outer layer made from a non-toxic BOPP film is applied that seals the leaf layer and protects it while maintaining the texture and feel of the leaves. This layer also provides water proofing, durability, and longevity. While not perfect (yet), when incinerated BOPP film only gives off water vapor and carbon dioxide. 5. With the leaf leather material complete and strengthened, it can now be sewn into any accessories imaginable.	All kinds of fashion bag.Such as wallet/ handbag/ backpack.	£15.00-£100.00 GBP	It's all handmade. The soaking and dyeing process requires a certain amount of water depending on the area of the leaf. The dyed water may cause contamination.	Can be naturally degraded or sustainably used.
Wineleather	Wineleather is a plant based leather obtained by the waste of wine production. Certifications: GOTS	Main producer is Italy. Main producer is Italy. The production is free from chemicals and heavy metals. Treating the waste from wine production, like skins, seeds and rasps of grapes, the result is a real leather-like material that can be used in the same way.	Already in use by fast fashion brand H&M Fashion Furniture Packaging Automotive Transportation	From 50€ to 1000€ Depending on the brand	Waste can be composted	Completely compostable

Illustrations



C O N C L U S I O N

- This report helps people who are environmentally aware to understand the latest sustainable materials transfer into products which can be used and where can be purchased in our daily life in order to purchase in a good and friendly way in our planet. There are some materials which are sophisticated into merchandises and can be processed to different sectors; however, some materials can be limited by cost to further development, because of experimented factors, they are a variety way to make into fabric or textiles.



- Educate younger generation in China and encourage global designers and retailers to support the fur-free movement is increasingly important. It's time to take a stance on the critical issues of protecting and caring for the environment. Consumers and retailers should avoid purchasing or selling fur to eliminate China's fur trade. Besides, fashion media has been to follow this trend to report more articles to eliminate fur. In a nutshell, the move comes as fur-free policies are adopted by more and more fashion brands, retailers and publishers, following rising activism on animal cruelty and the environmental impact of rearing animals for their skins.

References

Abnett, K. (2021) Inside the Growing Global Fur Industry. Available at: [https:// www.businessoffashion.com/articles/news-analysis/inside-the-growing-global-fur-industry/](https://www.businessoffashion.com/articles/news-analysis/inside-the-growing-global-fur-industry/) (Accessed: 5 December 2021)

Alive Boutique (2021) Available at: <https://www.alive.boutique/pages/industry-changing-vegan-leather-alternatives> (Accessed: 5 December 2021)

Bertelloni, L. (2021) Tessuti ecologici: innovativi filati green per l'abbigliamento. Available at: <https://www.architetturaecosostenibile.it/materiali/innovativi/tessuti-ecologici-filati-827> (Accessed: 5 December 2021)

China-Fur-Report from ACTAsia website <https://www.actasia.org/resources/types/pdfs/>

<https://www.ananas-anam.com/> (2017) (Accessed: 5 December 2021)

https://www.etsy.com/market/leather_leaves?utm_source=google&utm_medium=cpc&utm_campaign=Search_UK_DSA_GGL_ENG_General-Nonbrand_Catch-All_Ext&utm_ag=UK-EN_DSA-General&utm_custom1=_k_Cj0KCQiA-qGNBhD3ARIsAO_o7yldTBB7IA2Le75IOz8Qis9MIrOCONyXB58n3ZovDXRZcBl0r82q7BkaAmTPEALw_wcB_k_&utm_content=go_149164831_9465558751_544521405314_aud-463075091918:dsa-19959388920_c_&utm_custom2=149164831&gclid=Cj0KCQiA-qGNBhD3ARIsAO_o7yldTBB7IA2Le75IOz8Qis9MIrOCONyXB58n3ZovDXRZcBl0r82q7BkaAmTPEALw_wcB (2021) (Accessed: 5 December 2021)

<https://www.explore-leap.com/material> (2021) (Accessed: 5 December 2021)

<https://www.mylo-unleather.com/> (2021) (Accessed: 5 December 2021)

<https://www.nuo-design.com/> (2021) (Accessed: 5 December 2021)

<https://www.krilldesign.net/> (2021) (Accessed: 5 December 2021)

<https://thamon.co/> (2021) (Accessed: 5 December 2021)

https://www.tinyileather.com/?gclid=Cj0KCQiA-qGNBhD3ARIsAO_o7ykCrk6sbGCgLh-WJ62R6kbq9dl8_IQK4W1Psril-NL5g6I3Vj2OmK8aAsZ5EALw_wcB (2021) (Accessed: 5 December 2021)

<https://www.tomtex.co/> (2021) (Accessed: 5 December 2021)

<https://treetribe.com/> (2021) (Accessed: 5 December 2021)

<https://www.vegeacompany.com/v-textile/> (2020) (Accessed: 5 December 2021)

<https://yihsuansung.com/> (2021) (Accessed: 5 December 2021)

Kohlbacher, C. (2021) Grape Leather – The Vegan Wine Fabric From Vegea. Available at: <https://danandmez.com/blog/grape-leather/> (Accessed: 5 December 2021)

Material Innovation (2021) Innovator Profile. Available at: <https://www.materialinnovation.org/vegea-innovator-profile> (Accessed: 5 December 2021)

Nanda, M.C. (2021) Does Fur Have a Future?. Available at: <https://www.businessoffashion.com/articles/retail/does-fur-have-a-future/> (Accessed: 5 December 2021)

NUO GmbH (2020) NUO (FORMELY LIGNEAH). Available at: <https://materialdistrict.com/material/nuo/> (Accessed: 5 December 2021)

O'Connor, T. (2021) Why Fashion's Anti-Fur Movement Is Winning. Available at: <https://www.businessoffashion.com/articles/news-analysis/why-fashion-anti-fur-movement-is-winning/> (Accessed: 5 December 2021)

Saluja, M. (2011) Soybean Fibers - A Review. Available at: <https://www.fibre2fashion.com/industry-article/5924/soybean-fibers-a-review> (Accessed: 5 December 2021)

<https://www.fibre2fashion.com/industry-article/5924/soybean-fibers-a-review> (Accessed: 5 December 2021)

Sewport Support Team (2021) What is Soy Fabric: Properties, How its Made and Where. Available at: <https://sewport.com/fabrics-directory/soy-fabric> (Accessed: 5 December 2021)



ACTAsia-The researcher