

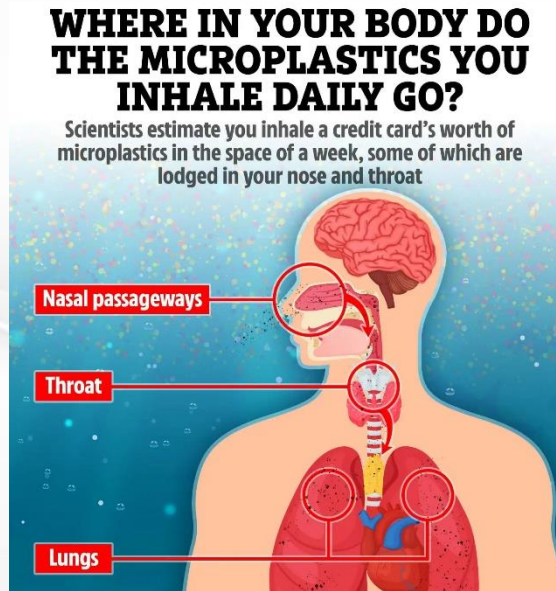


# Sustainable Packaging Solutions

# Saying Goodbye to Plastic Packaging

Humanity produces more than **430 million tons** of plastic annually. Overall, **46%** of plastic waste is landfilled, while **22%** is mismanaged and becomes litter. Only **9%** plastic is successfully recycled.

The **packaging sector** is the largest generator of single-use plastic waste in the world.



**Microplastics are inevitable:** from trash, dust, fabrics, cosmetics, cleaning products, rain, seafood, produce, table salt, and more. Using less plastic is the only way to avoid nanoplastics.

Pave the way to a future with **100% fiber-based packaging**. Goodbye, plastic packaging.

# Paper Packaging VS Plastic Packaging

|                   | RECYCLED CONTENTS (%) | RECYCLE TIMES | TIME TO BIODEGRADE (YEARS) |
|-------------------|-----------------------|---------------|----------------------------|
| Paper             | 100                   | <7            | 0.2                        |
| Plastic (30% PCR) | 30                    | <3            | 500                        |

\*Plastic waste is also expensive to manage. The estimated global cost of municipal solid waste management is set to increase from \$38 billion in 2019 to \$61 billion in 2040 without action to address the issue.

**Recycle rate:**

Paper(~70%) > glass / Aluminum(~60%) > Plastic (~9%)

# Natural Degradation Period of Different Fibers

| Name                 | Type                                                                                | Products                                                                             | Degradation Period | Degradation Progress                                                                  |                                                                                         |
|----------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
|                      |                                                                                     |                                                                                      |                    | 25 days                                                                               | 52 days                                                                                 |
| Sugarcane pulp paper |    |    | 52days             |    | →    |
| Bamboo pulp paper    |    |    | 52days             |    | →    |
| Wood pulp paper      |   |   | 52days             |   | →   |
| Recycled paper       |  |  | 63days             |  | →  |

# Fiber-based Packaging

Fiber-based materials have reduced environmental impacts as compared to fossil-based counterparts, if a similar packaging weight is obtained. Indeed, all impacts of plastics are between 3 - 5 kg CO<sub>2</sub>eq/kg, while all impacts of cellulosic fiber-based materials are **below 1.5 kg CO<sub>2</sub>eq/kg**.

Molded fiber is mainly made from bamboo and bagasse. These materials use **10 times less energy** to produce with **~60% carbon emission reduction** than tree-based materials.



**Less Growing Time**



**Less Chemical Usage**



**Less Processes**

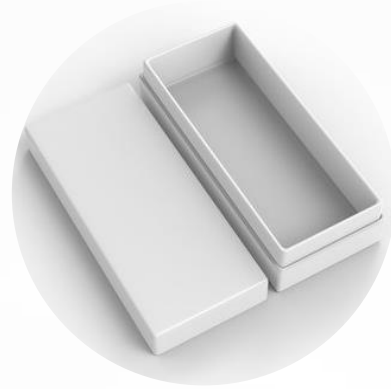


**Less Transportation Costs**

# Packaging Sustainable Solutions



**PP Lam Replacement**  
Coating solutions to replace plastic lamination



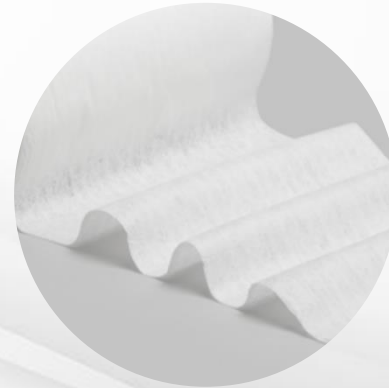
**Light Weight Paper Box**  
Redesign structure to reduce box weight, maintaining functionality



**Foil Stamping Alternatives**  
Sustainable alternatives for metallic effect



**Molded Fiber Design**  
100% fiber-based design



**Anti-scuffing Solution**  
Replace plastic wrap to protect device surface

- Direct formation from pulp to box, minimal process compared to paper
- Lower carbon/water footprints
- Customizable shapes and sizes
- Organic, warm and premium feels



- Direct from pulp to finish goods, replacing plastic materials
- Barrier properties
- Patented closure design





# Fiber-based Packaging Design - Humane Ai Pin



## Technology Highlights:

- Dual cosmetic sides
- Different thickness on one part
- The narrowest groove (outside: 5.5mm, inside: 3.5mm) based on the height
- 1mm flat MF plate without curling or deformation, planeness: 0.3
- Anti-scuffing non-woven bamboo fiber label
- Registration mark on forming tool, for fixture, surface treatment and die-cutting

**Humane Ai Pin  
released on  
11/9/2023**

# Non-woven Fabric Material



While poly bags and films are an essential part of the supply chain, protecting products as they pass through each stage, they have **an undoubtedly negative impact on the environment**.  
Are there any eco-friendly alternatives?

The non-woven fabric packaging is **100% biodegradable** with excellent anti-static and dustproof properties.



Bamboo fiber



Cotton fiber



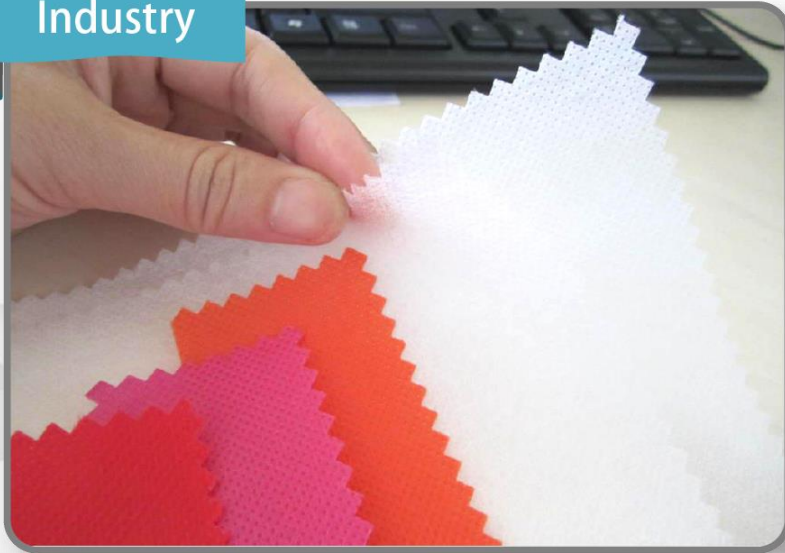
Seaweed fiber

Shorter growth cycle



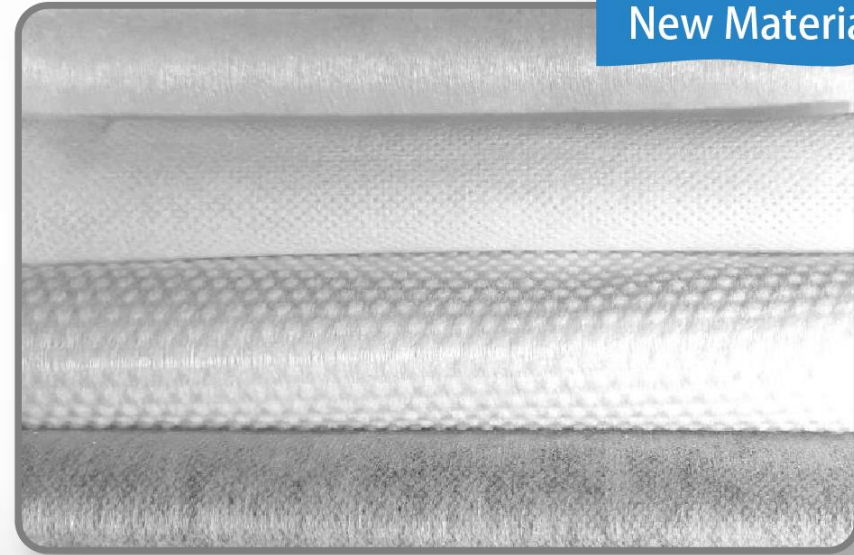
# Bamboo Fiber Non-woven Fabric

Industry



Plastic(Polypropylene-fossil-base) non-woven fabric

New Material



Spun laced bamboo non-woven fabric

- 100% wood free fiber, compostable
- Comply to ISOEN13430/ EN13432; ASTM D6400
- Excellent anti-static, dustproof properties

# Bamboo Fiber Non-woven Fabric

Plastic Free, 100% bamboo fiber

SGS certified, 100% fiber structure



Fiber structure: 5-10 times magnified


**SGS**

**TEST REPORT**  
No. : SZ.N211014977PS  
Date : Nov 30, 2021  
Page: 2 of 4

Summary of Results:

| No. | Test Item                              | Test Method         | Result    |
|-----|----------------------------------------|---------------------|-----------|
| 1   | Major Composition Qualitative Analysis | ASTM E1252-98(2021) | Cellulose |

Original Sample Photo:



Member of the SGS Group (SGS SA)

# Bamboo Fiber Non-woven Fabric

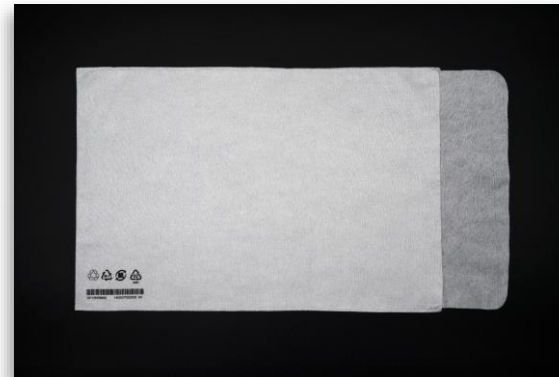
Application

## Application:

Substitution for polybag, shielding bag, dustproof sheet



In mass production



Bamboo Non-woven Fabric

# Bamboo Fiber Non-woven Fabric

Application

## Application:

Wrap MF pulp tray or rigid box for protective and cosmetic purpose with cold lamination



In mass production

# Fiber-based Soft Paper

---

- FSC certified
- Soft and smooth
- Customizable size, color and density
- Thickness: 0.1-0.5 mm
- Weight: 15-300 gsm



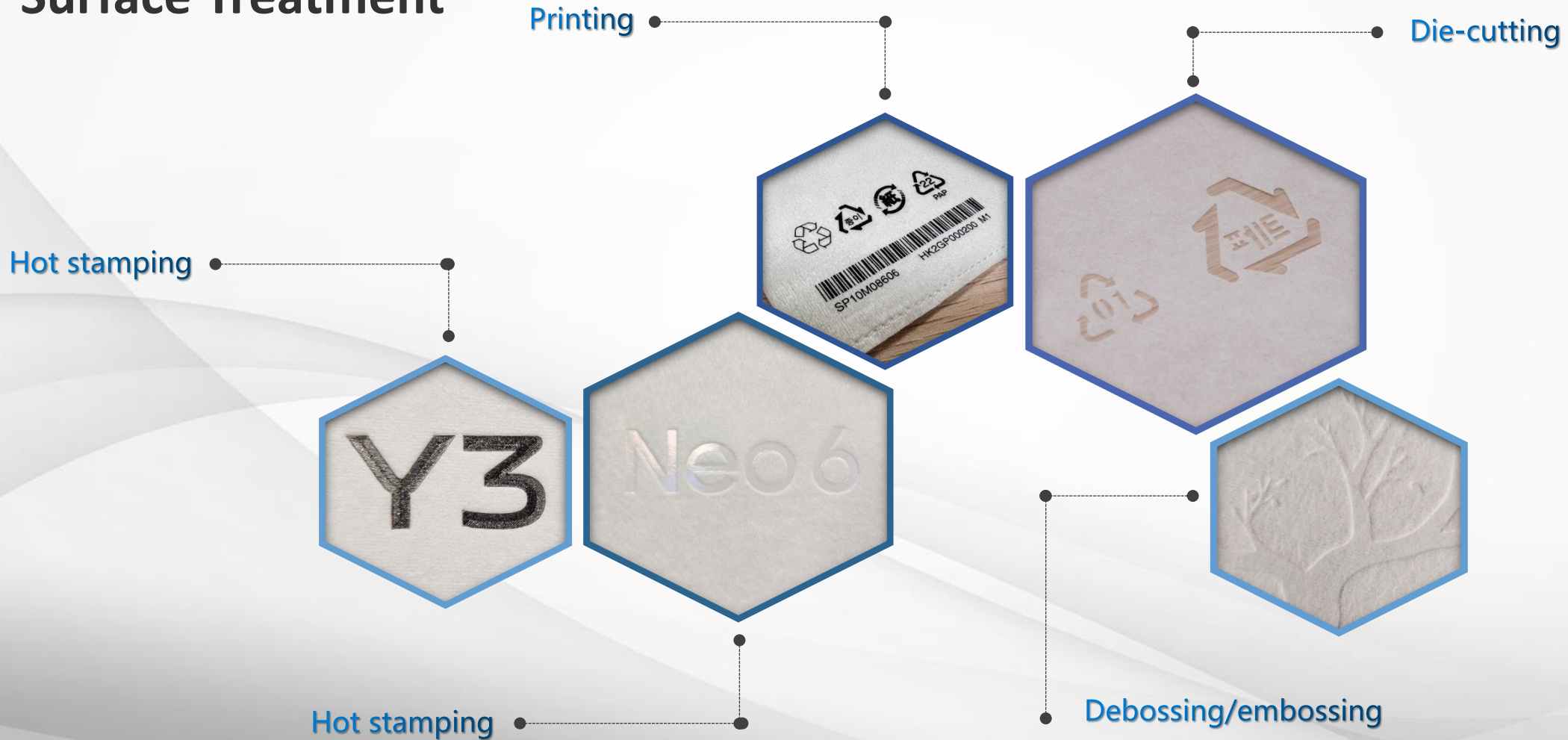
## Application:

Substitution for polybag, anti-scuffing bag, moisture barrier bag, dustproof sheet





## Surface Treatment



# Molded Fiber Bubble Wrap

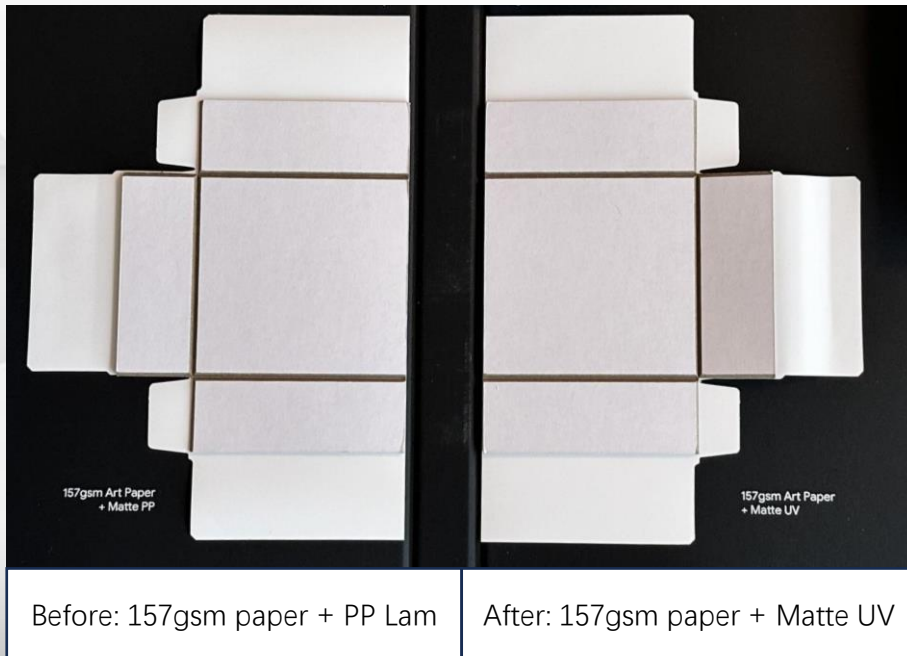


## **Innovated Bubble Fiber Paper:**

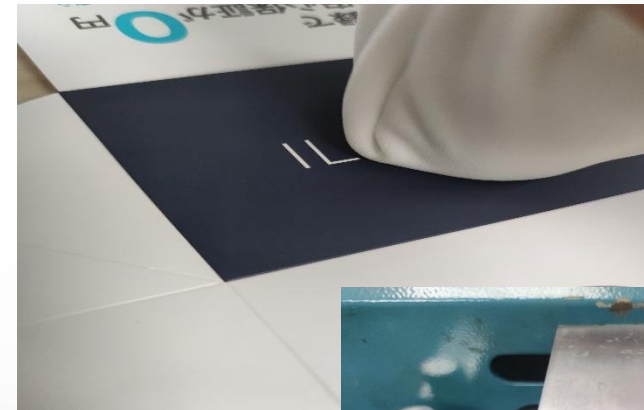
- Customized surface texture
- Thickness from 0.6-2.0mm
- Weight from 15-300gsm
- FSC certified

# PP Lamination Replacement

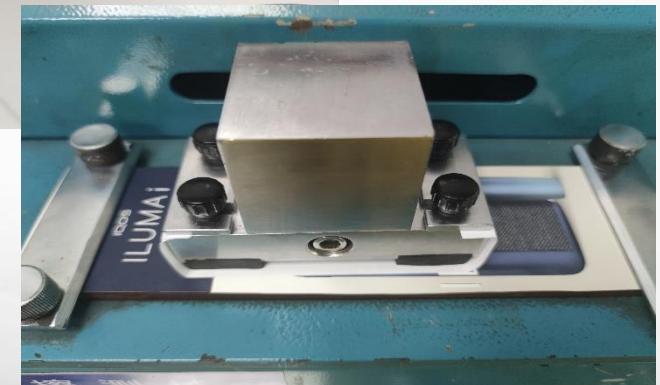
Liquid coatings like aqueous coating, UV coating can be applied in-line by the printer as part of the printing process or off-line after the project leaves the press. Different coatings are available in different finishes, tints, textures and thicknesses, which may be used to adjust the level of protection or achieve different visual effects.



Google packaging



250gsm paper + aqueous coating rub testing passed



PMI packaging

# Coating Solution: Paper Repulpability & Recyclability

**W WESTERN MICHIGAN UNIVERSITY**



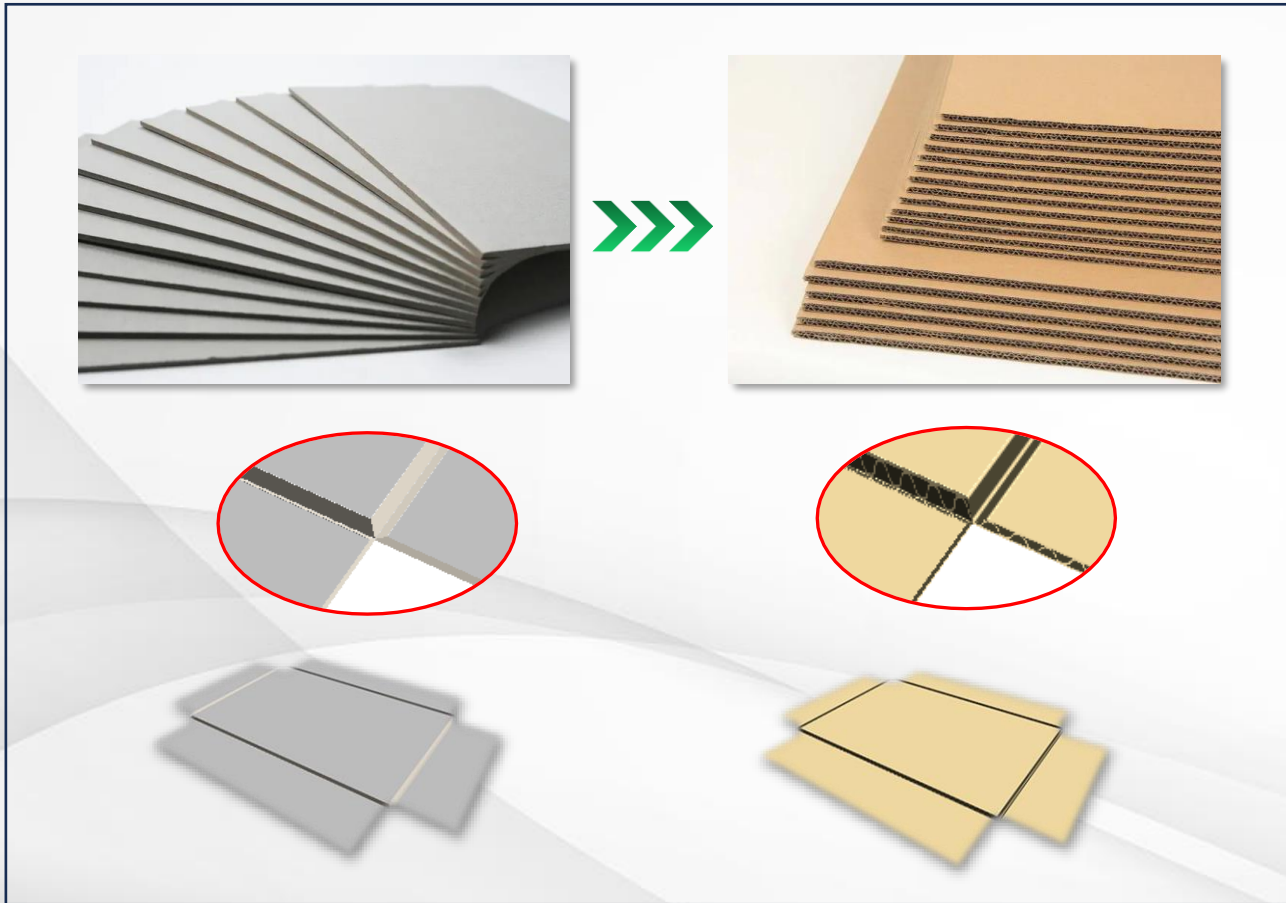
Tested by Western Michigan University (WMU), leveraging their expertise at the Paper Pilot Plant, to certify recyclability for the coating, varnish, ink, and paper combinations.

The certification protocol involves two distinct phases.

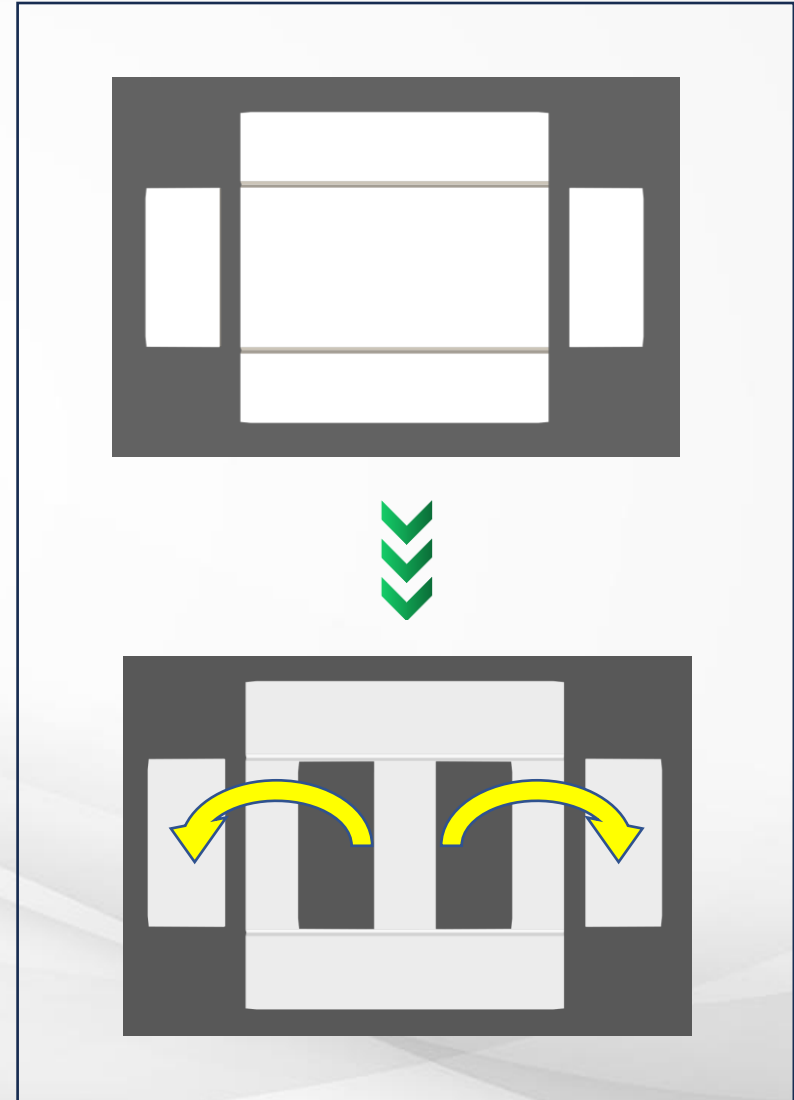
1. Lab scale testing
2. Pilot scale testing

The Megami varnish has been successfully implemented at scale.

# Light-weight Paper Box



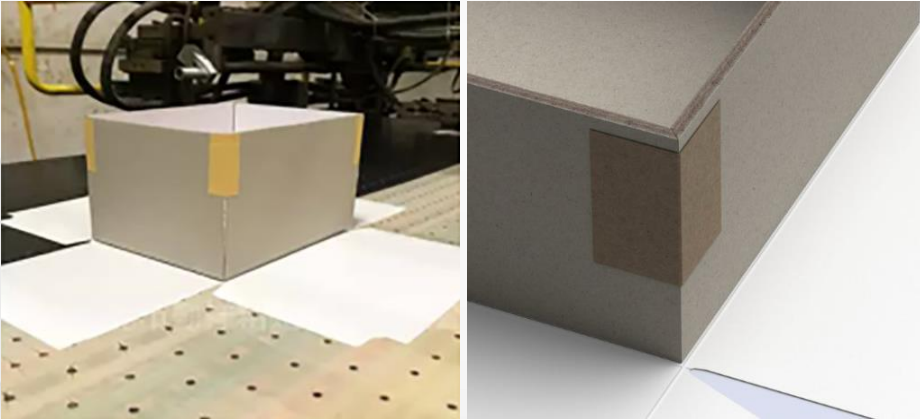
- Use corrugated board instead of greyboard
- Hollow greyboard design



# Light-weight Paper Box

---

## Corner Label



## Closure label

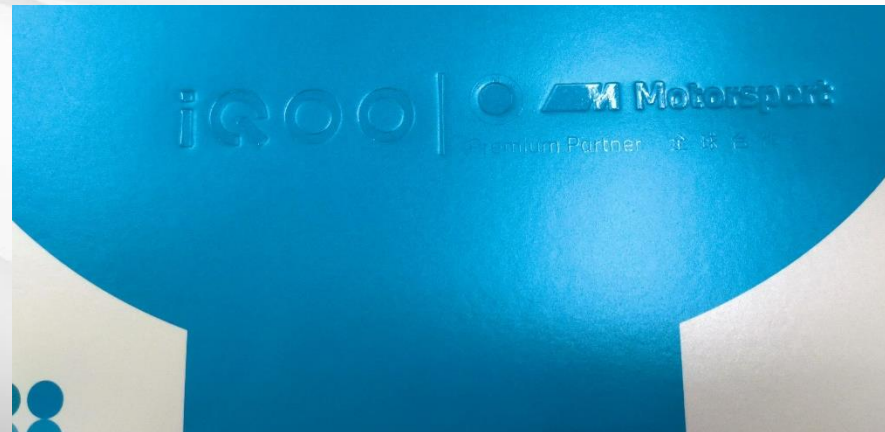
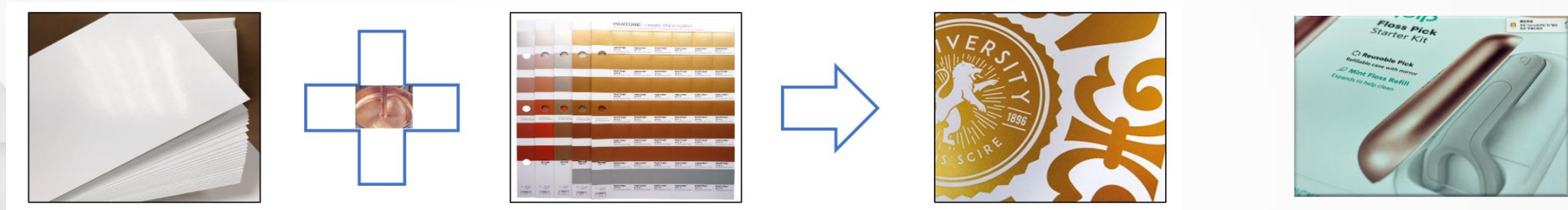
### Paper tape:

A robust tape solution is essential to prevent corner tearing during a drop and ensure the vertical box walls stay perpendicular to the bottom panel.

- Met plastic tape corner tape performance.
- Compatible with our automated tape application process.
- Had minimal thickness to prevent witness lines seen on the finished box.

# Foil Stamping Replacement: Metallic Color Printing

White paper cardboard + metallic spot color printing + surface treatment (embossing, spot UV) to simulate effect of hot foil stamping.





The color pigment currently in use for molded fiber is synthesized by a chemical process.

- In-pulp additives, high coloring rate, compliant with ROHS/ REACH/ CPSIA etc.
- The products do not contain heavy metals and hazardous compounds prohibited by the European Union.

Natural dye is available, but the selection is limited, and has poor color stability, easy to decompose, also with lower yield, and expensive.







## Hazards of mineral oil

Studies have shown that both MOSH and MOAH are readily absorbed by different tissues in human organs, thus causing health hazards.

The most critical part is that PAH with 3-7 rings and little or no alkylation are genotoxic carcinogens, while some highly alkylated MOAH are not carcinogens per se but can act as tumor promoters.

## Advantages of mineral-free inks

- 100% composed of vegetable oil, natural and non-toxic, no damage to human and environment, VOCs emission will be reduced, which is good for environment and health.
- Can be applied to any printing machine without any modification and no special cleaning agent is needed. Customers can fully use Eco Ink, and even if the ink need to be replaced, the handling method is the same as the common ones.



# Innovative Paper and Fiber Materials

Paishing partners with attitude-driven, eco-friendly paper and fiber based material suppliers all over the world. Based on your specific requirements for texture, color, functionality, cost and more, we deliver customized solutions tailored to your needs.



Paper with recycled content,  
different fiber formula



Translucent paper wrap



Non-woven fiber fabric



Paper tape

**To achieve a zero plastic future, start with packaging that's plastic-free. Let's collaborate on eco-friendly alternatives.**

**THANK YOU!**