

MINIFIBERS, INC.

Fybrel® for Molded Fiber Applications
Producing High Strength Molded Fiber Products

IMFA Meeting
March 27, 2015
Jeff Hyde

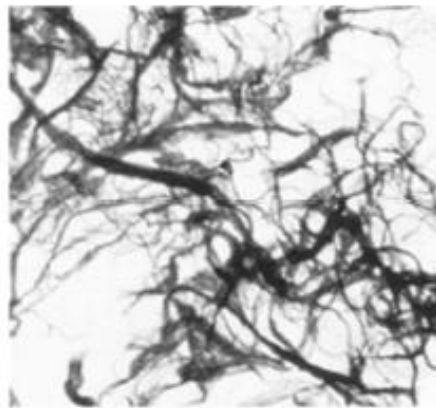
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What is Fybrel®?

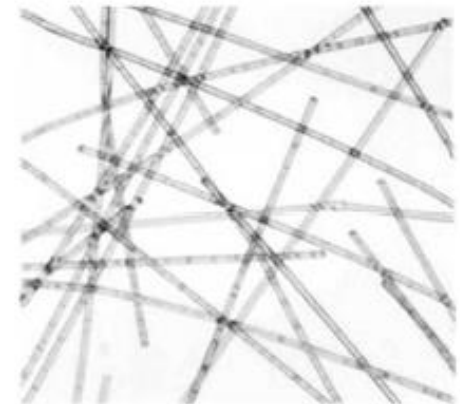
Fybrel (Polyolefin Synthetic Pulp) is
a **hydrophilic,**
highly fibrillated,
polyolefin fiber



Wood pulp



Fybrel®



Polyolefin
cut fiber

Process for Production of Fibrillated HDPE

Process patent by Crown Zellerbach – 1970s

HDPE $\xrightarrow{\text{Hexane}}$ HDPE solution in hexane

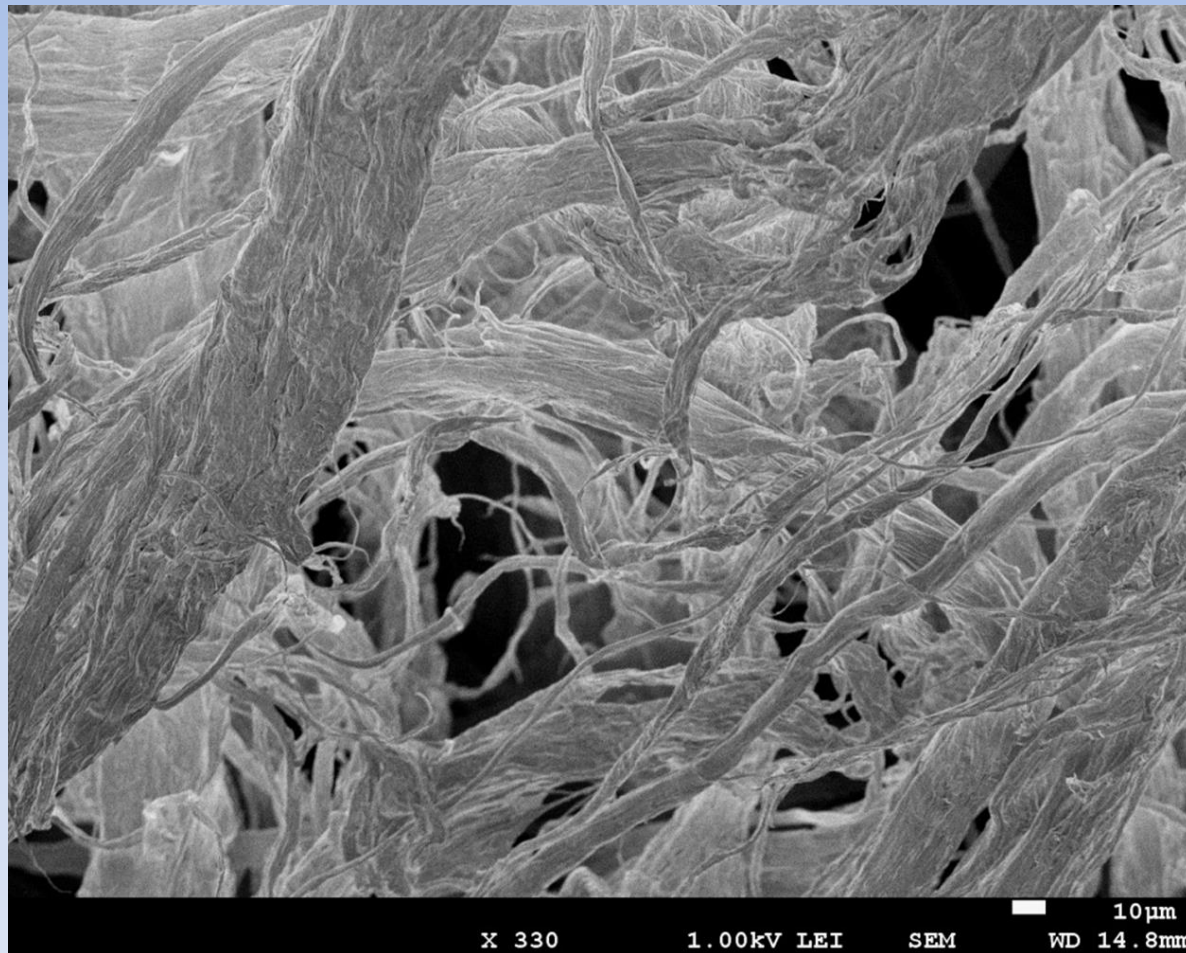
+ PVOH \longrightarrow Emulsified HDPE/hexane PVOH

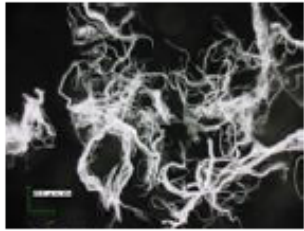
Pressure through die $\xrightarrow{\text{vacuum}}$ base fiber produced

$\xrightarrow{\text{Refined to cut length}}$ Finished product

Synthetic Wood Pulp

This is a single fiber – the main branch is 20 microns in Diameter but the three dimensional structure is complex!





Features and Applications

Features

Highly Fibrillated

Fine

Polyolefin

Hydrophilic

Functions

Binding

Pore Size Control

Chemical resistance

Processability

Mixing

Applications

Tea Bag

Coffee Pod

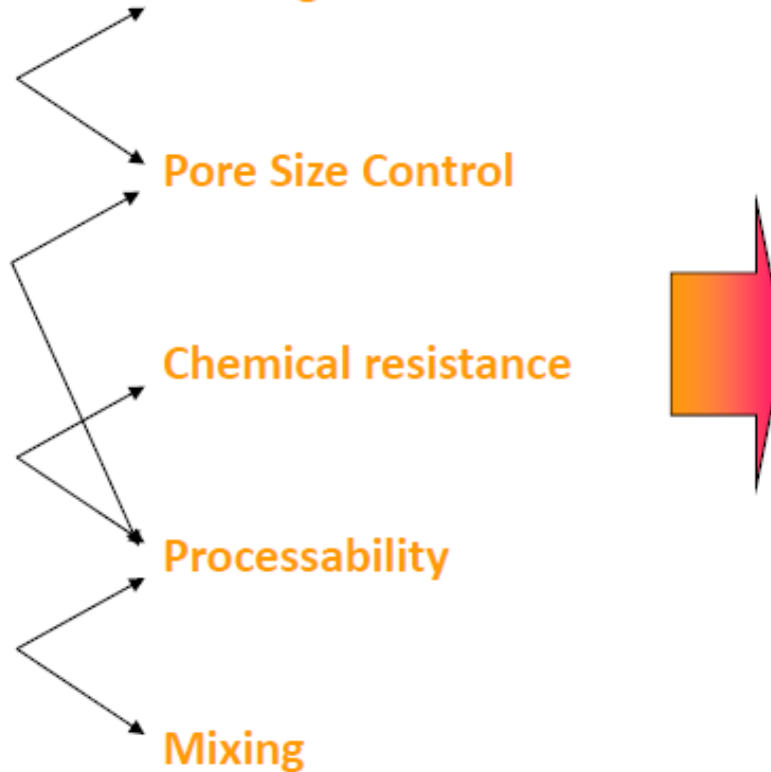
Printing Paper

Decorative Paper

Paint

Cement

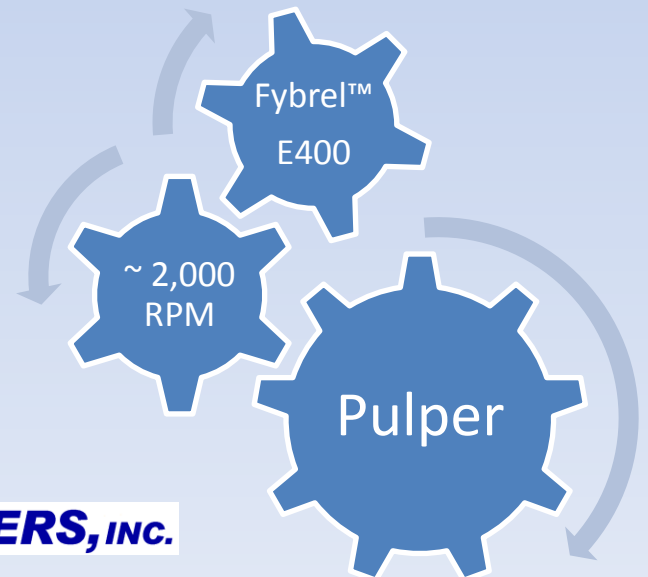
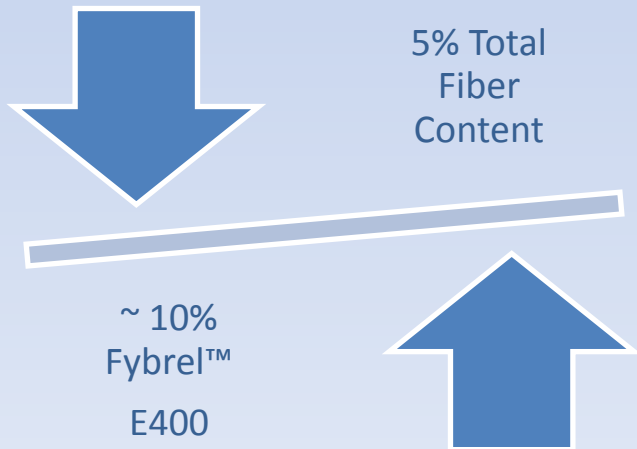
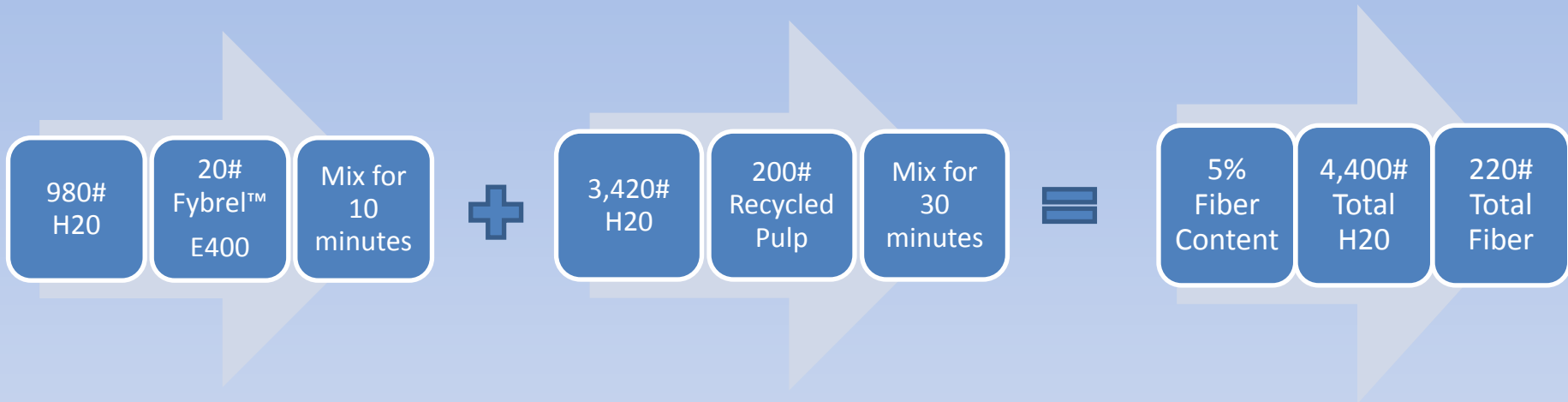
Industrial Appl.



Using Highly Fibrillated HDPE in Molded Fiber

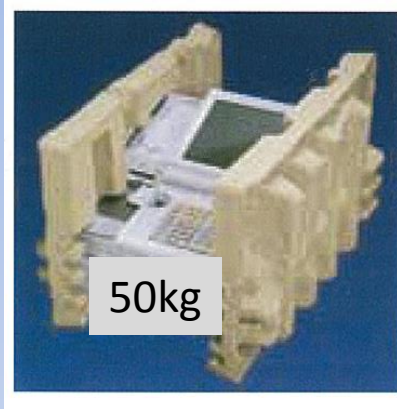
- Produce articles of high durability and strength
- Loaded 15% or less maintain re-pulpability
- Process similar – one added heat setting step
- Articles possess
 - Higher tensile, flexural, tear strengths
 - Greatly increased abrasion resistance

Molded Fiber Process with Fybrel[®] Added

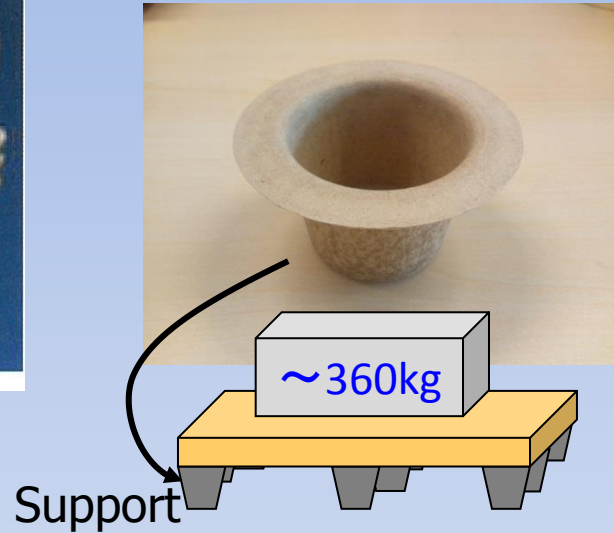


Examples of molded fiber using Fybrel®

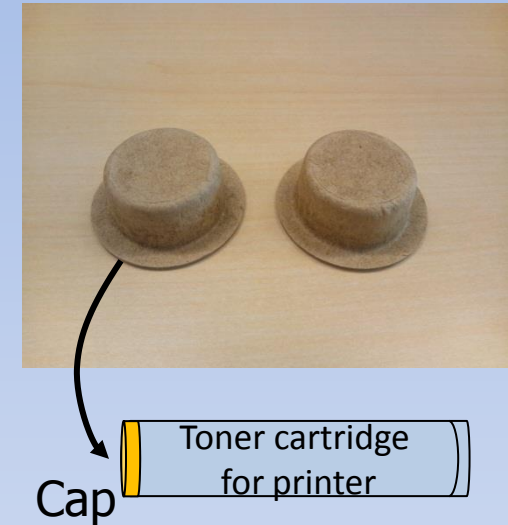
Ex.1)
Mold for register



Ex.2)
Support for paper pallet



Ex.3)
Cap for electronic parts



Merit

- High load resistance

Blending ratio

- Fybrel; 5%
- Waste paper; 95%
(Corrugated fiberboard)

Merit

- Higher load resistance

Blending ratio

- Fybrel; 15%
- Waste paper; 85%
(Corrugated fiberboard)

Merit

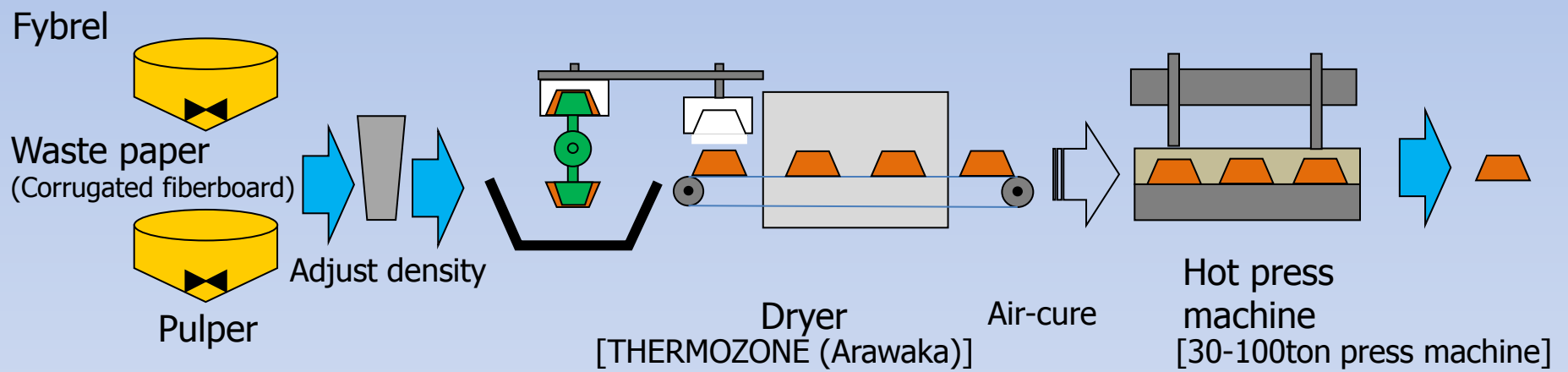
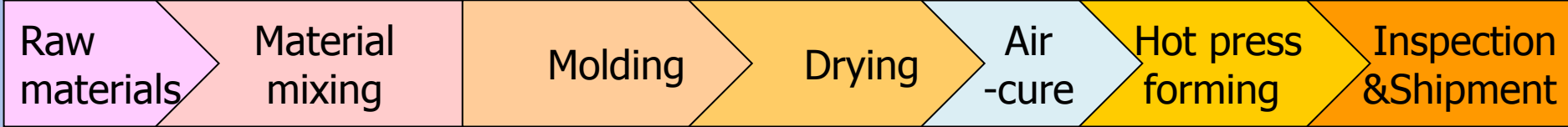
- Dimension stability

Blending ratio

- Fybrel; 15%
- Waste paper; 85%
(Corrugated fiberboard)

Manufacturing flow of molded fiber using Fybral®

Manufacturing flow of pulp mold using Fybral



Condition *

Mixing time;
30-40min.

Drying time;
10-30min.
Temperature;
100-180deg-C

Air-Cure time;
3days-1month

Press time;
About 1min.
Temperature;
About 200deg-C

These conditions depend on the product.

*) Example of a Japanese pulp mold manufacturer "TAISEI Co., Ltd."

Details on using Fybrel® for molded fiber

Recommendation Grade of Fybrel

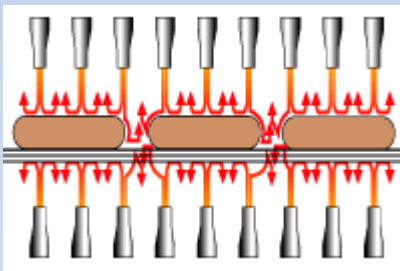
1. E400 (Standard)
2. E620 (Good disperse-ability)

Recommendation condition of disintegration

1. Pulper for low-middle concentration disintegration
2. Concentration of Fybrel; 2%
3. Water temperature; 40-60 deg-C
4. Disintegration time; about 30 min.

Recommendation equipment

1. Dryer : A dryer "THERMOZONE" manufactured by Arakawa Co. Ltd



For drying

In this system, the high speed air jetted out from the Jet-Tubes placed both above and under the product passing zone vertically hits the upper and back sides of the product, breaks the boundary layers containing a lot of moisture on the surface of the product. This enables to reduce the treatment time drastically.

The air containing much moisture which comes out of the product is circulated for removal of the moisture and re-heating.

The air to be jetted out from the Jet-Tube is controlled in the pressure plenum so that a uniform processing could be made at any point of the product passing zone.

Advantages using Fybre[®]

Physical Property Improvements

Molded pulp : Tray & Cardboard

Molded Pulp	Item	With Fybre (15%)	Without Fybre
Tray	Compressive strength (N)	584	200
Cardboard	Bending strength (MPa)	13.3	6.1
	Tensile strength (MPa)	9.1	3.7
	Tear strength (the crepe method) (N/cm)	603	224
	Surface friction strength (taper abrasion) Friction loss (mg)	2.8	117

Compressive strength : tray , 10mm/min

Bending strength : cardboard , 25mm strip of paper , Span interval : 32mm, 1mm/min

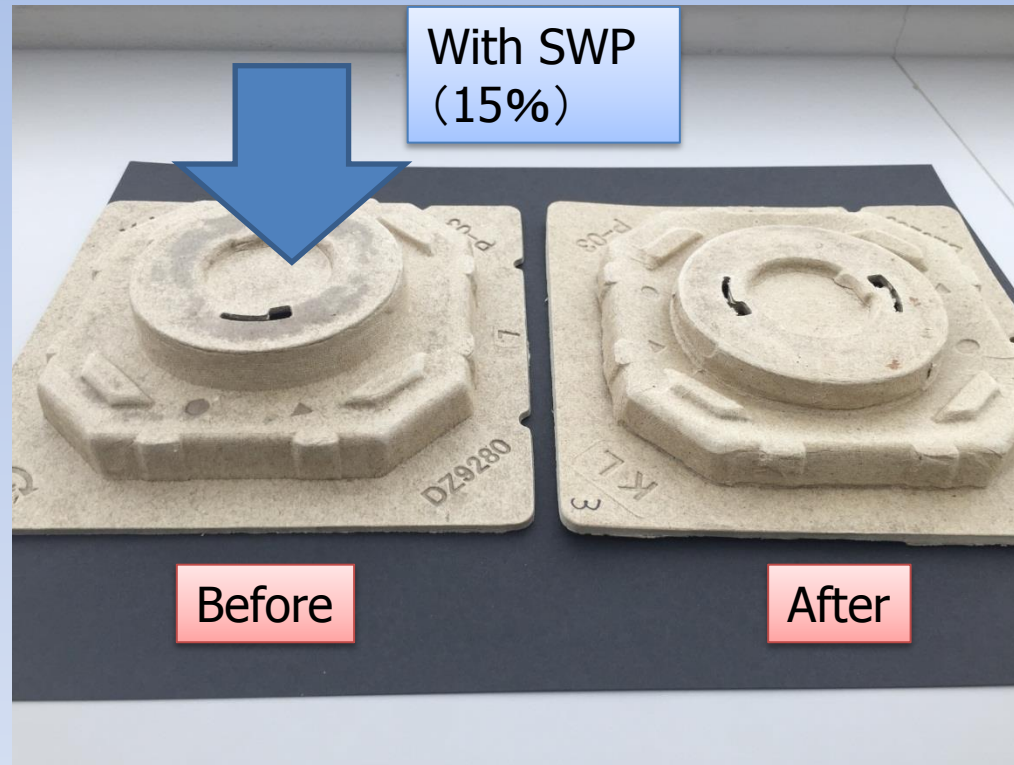
Tensile strength : cardboard , 15mm strip of paper , Chuck interval : 100mm, 10mm/min

Tear strength : cardboard , Crepe piece , Chuck interval : 56mm, 200mm/min

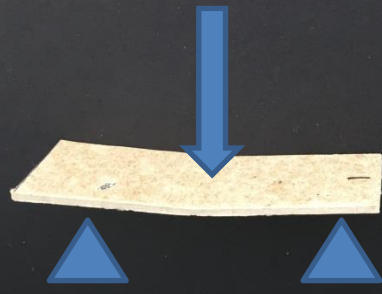
Friction strength : cardboard , CS-10, 1000g, 60r.p.m., 100 times

Method

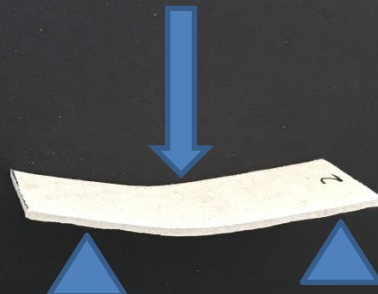
Compressive strength: tray, 10mm/min – Improved 292%



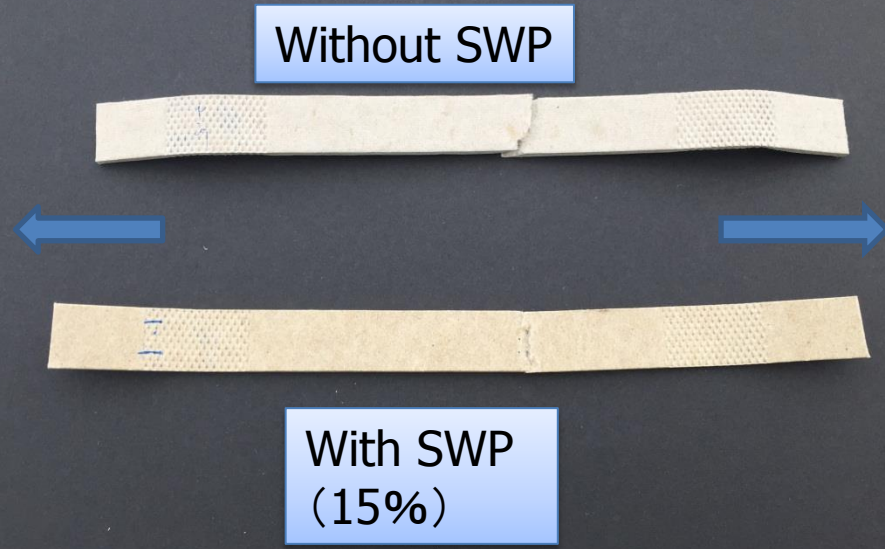
Method



**With SWP
(15%)**



Without SWP



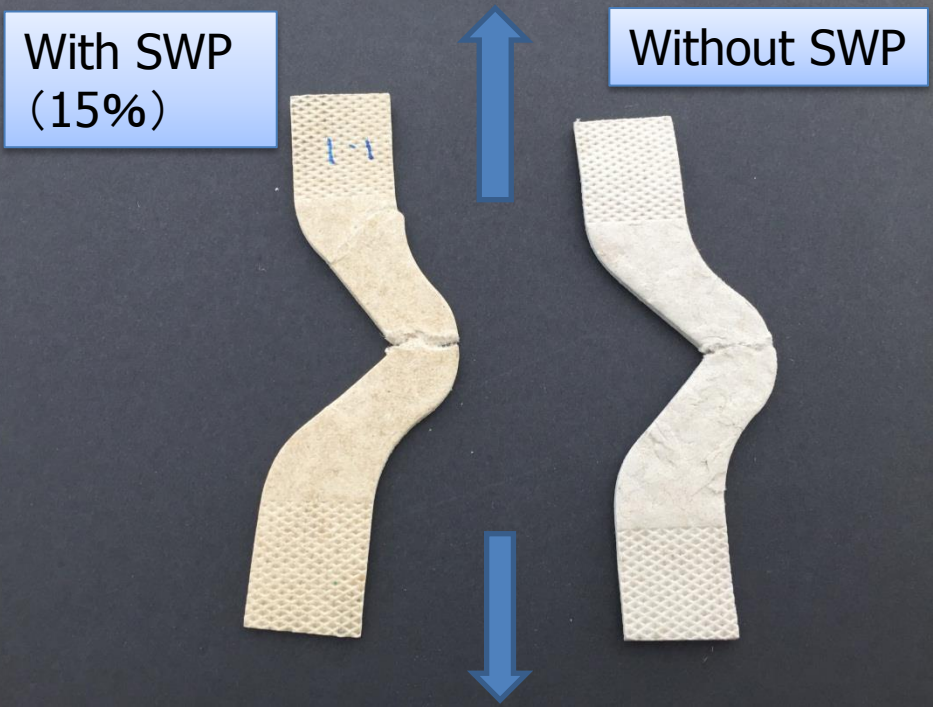
Without SWP

**With SWP
(15%)**

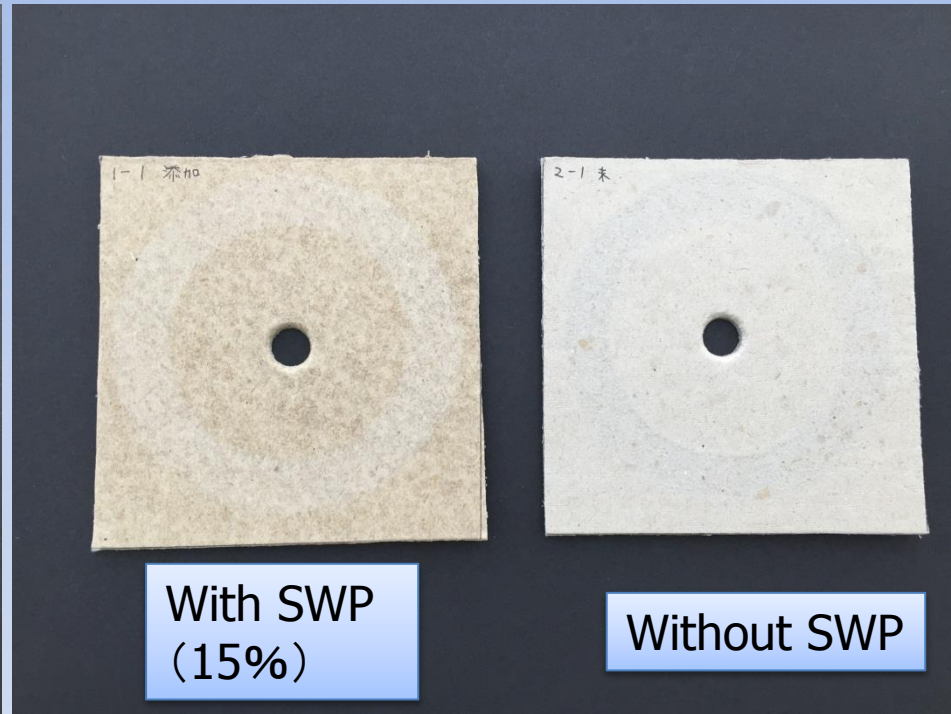
Bending strength : cardboard ,
25mm strip of paper , Span interval :
32mm, 1mm/min
Improved 218%

Tensile strength : cardboard , 15mm
strip of paper , Chuck interval : 100mm,
10mm/min
Improved 245%

Method



Tear strength : cardboard , Crepe piece , Chuck interval : 56mm, 200mm/min
Improved 247%



Friction strength : cardboard , CS-10, 1000g, 60r.p.m., 100 times
Improved 42X!

Summary

- Highly Fibrillated HDPE contributes to
 - Higher compression strength (nearly 3X)
 - Higher tensile strength (nearly 3X)
 - Higher flexural strength (>2x)
 - Higher tear strength (nearly 3x)
 - Higher abrasion resistance (>40X)

At 15% loading – molded articles are re-pulpable and remarkably durable

MAKE PRODUCTS TO COMPETE WITH PLASTICS!!

Thank You!