

# Nonwood Fibers in Molded Pulp Manufacture

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# TYPES OF MOLDED FIBER PRODUCTION

- ▶ Type 1 Thick Wall
- ▶ Type 2 Transfer Molded
- ▶ Type 3 Thermoformed
- ▶ Type 4 Processed

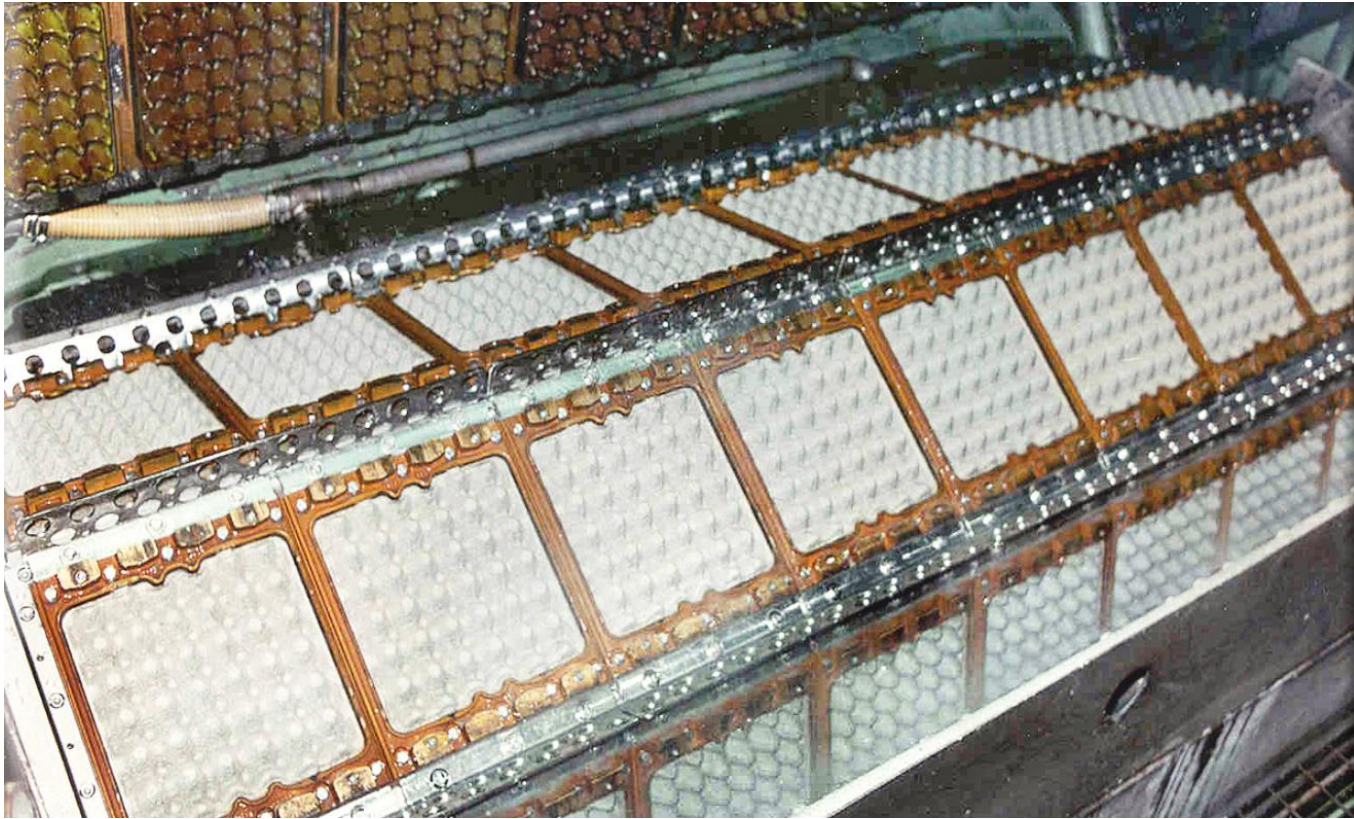
# TYPES OF MOLDED FIBER PRODUCTION

- ▶ **Type-1 Molded Fiber Products - Thick Wall**
- ▶ Manufactured using a single mold with product wall thickness from about 3/16 to 3/8 inches (5mm to 10mm). One surface is relatively smooth, with one side rough. Primarily used for support packaging of non-fragile, heavier items. (vehicle parts; furniture, motors etc.). As well as, plant, floral and nursery pots and containers. Oven dried.

# TYPES OF MOLDED FIBER PRODUCTION

- ▶ **Type-2 Molded Fiber Products - Transfer Molded**
- ▶ Manufactured using one forming mold and one transfer mold with product wall thickness from about 1/8 to 3/16 inches (3mm to 5mm). Surfaces are relatively smooth on one side. Most common use is for egg cartons and trays. New designs are used for many types of electronic product packaging such as cell phones, DVD players etc. Also, used for hospital disposables, electrical appliances, office equipment, tableware and fruit and drink trays. Oven dried.

# Rotary Former



# TYPES OF MOLDED FIBER PRODUCTION

- ▶ **Type-3 Molded Fiber Products - Thermoformed (Sometimes called “thin-wall”)**
- ▶ Manufactured using multiple heated molds with product wall thickness of about 3/32 to 5/32 inches (2mm to 4mm). Surfaces are smooth and forms are well detailed with minimal draft angles. Products are dried in the mold and no oven curing is needed. Due to the hot mold pressing process, the walls are somewhat more dense. Type-3 thermoformed fiber, products closely resemble Thermoformed plastic material.

# TYPES OF MOLDED FIBER PRODUCTION

- ▶ **Type-4 Molded Fiber Products - Processed**
- ▶ This type refers to molded fiber products that require some type of secondary or special treatment other than simply being molded and cured.
- ▶ Examples of Type-4 are:
  - ▶ Hot or after pressed - Die-cut or perforated - Printed - Colored - Special mold
  - ▶ Special slurry formulations - Embossments - Special design features - Special additives



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# Phoenix Wheat Straw Pulp for Blister Pack



Genera Energy (Courtesy Photo)

# Molded Pulp Packaging Replacing Blister Pack









# WHY NONWOOD FIBERS

- ▶ Newsprint has been used traditionally for products like egg cartons
- ▶ Virgin Fibers for FDA required products
- ▶ Better strength than hardwoods
- ▶ Natural hydrophobicity and oil resistance

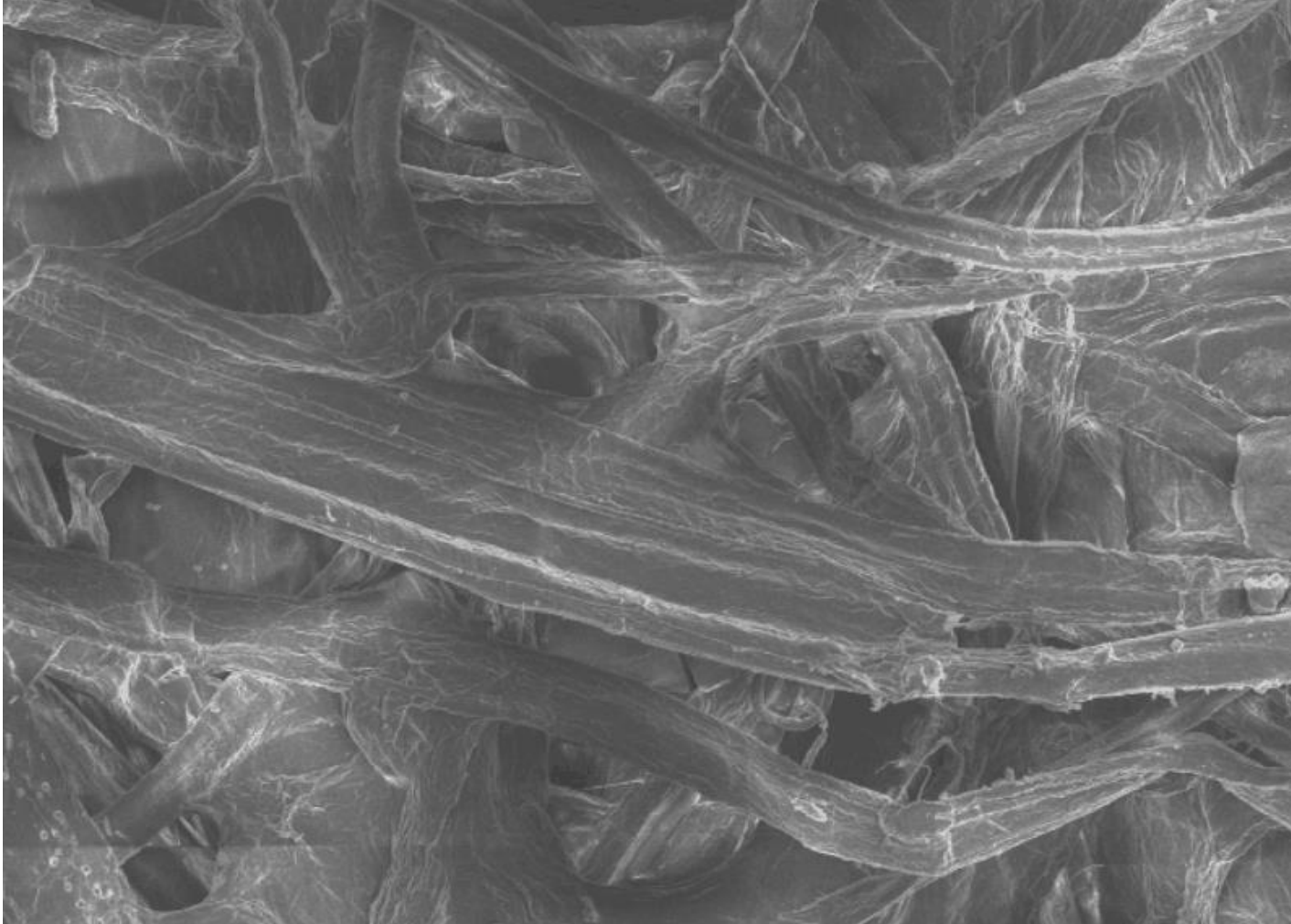
Per & Polyfluoroalkyl Substances Issues

San Francisco now bans PFAs in direct food contact

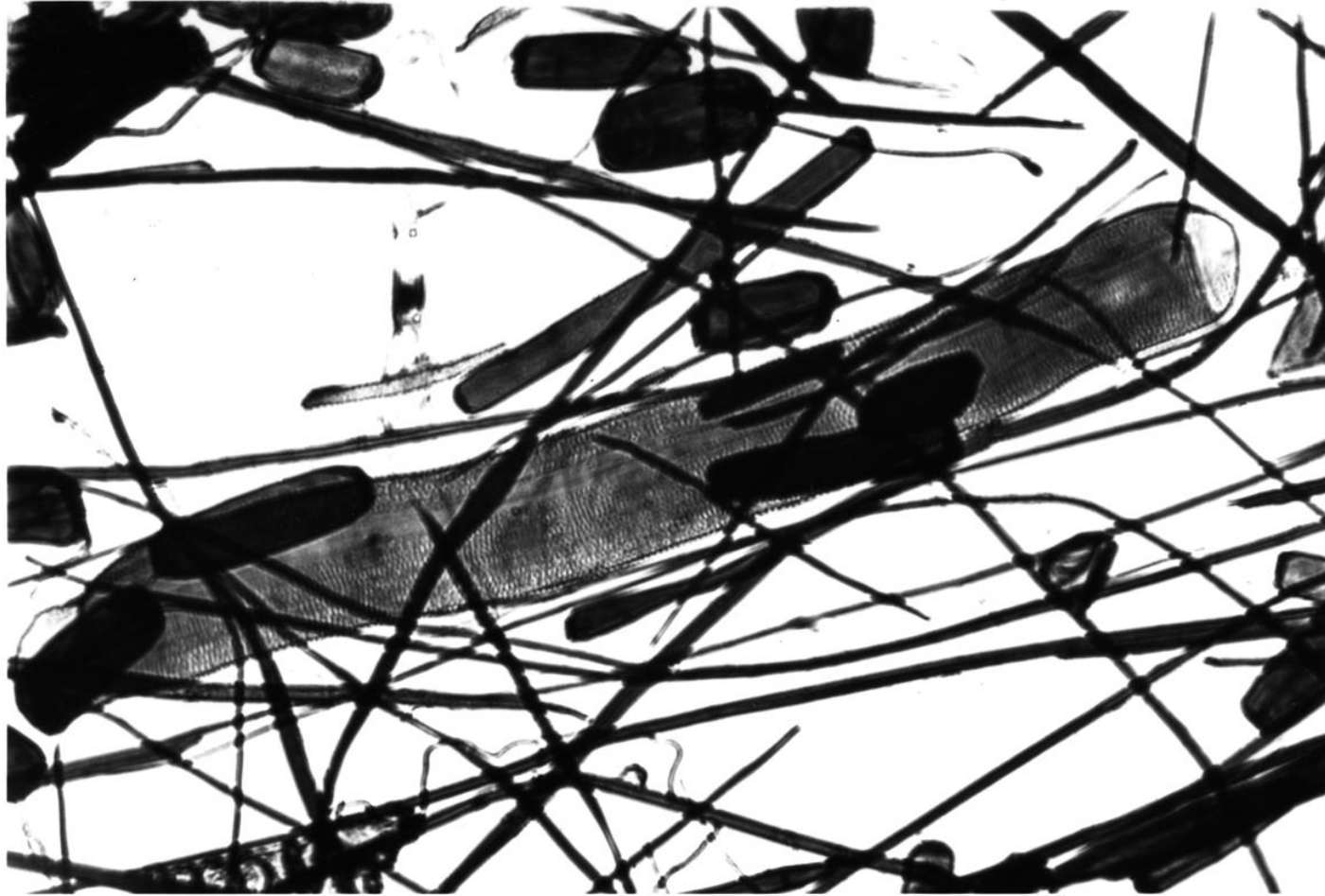
# Tensile Index Results

	500 CSF	400 CSF	300 CSF
Wheat Straw	40	58	68
Bagasse	44	54	60
Bamboo	40	56	67
Arundo donax	44	58	70
Miscanthus	38	42	52
Energy Sorghum	40	56	68
Aspen	19	36	48
Maple	15	26	37
Eucalyptus	20	38	60

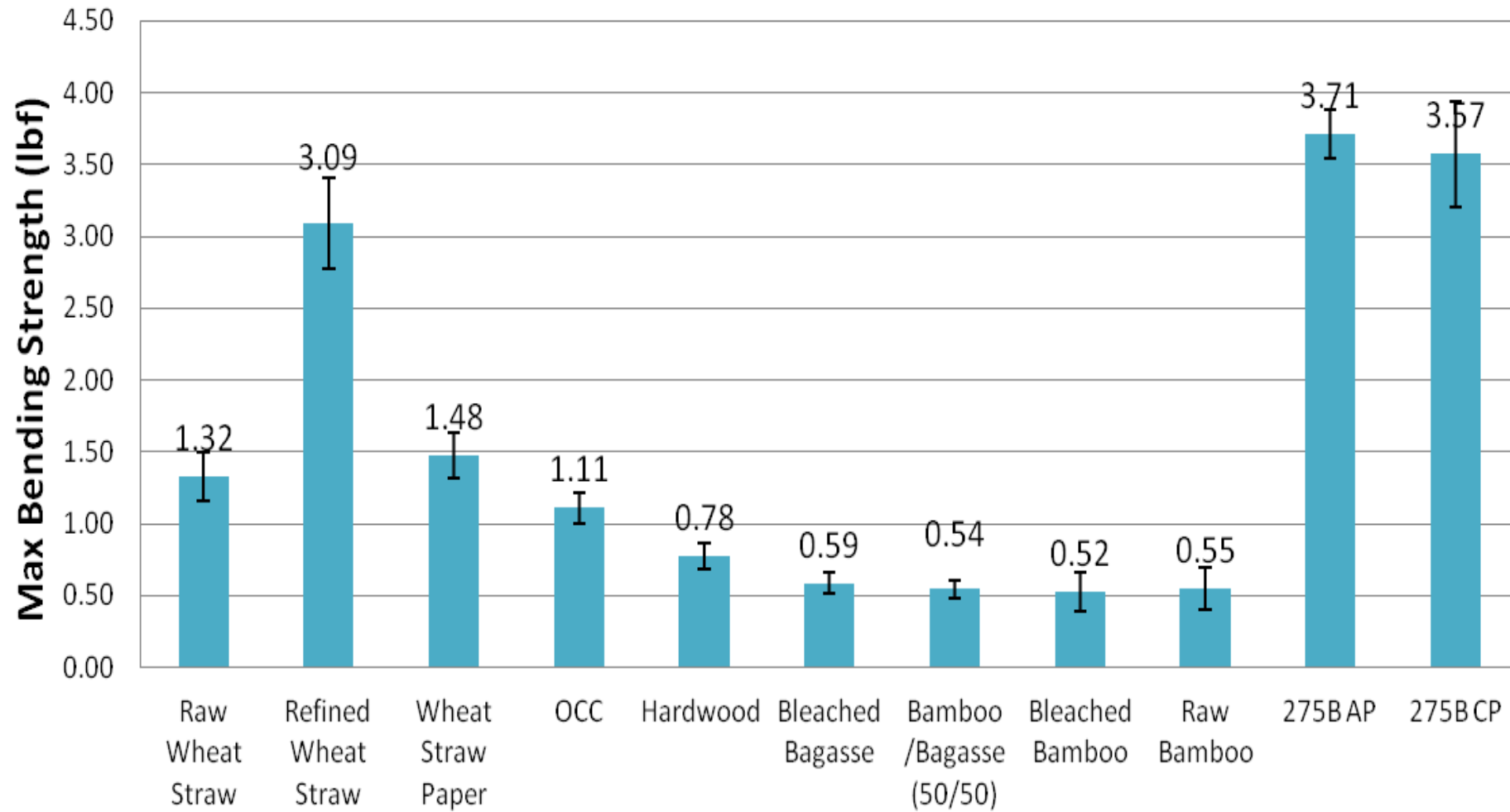
# Wheat Straw SEM



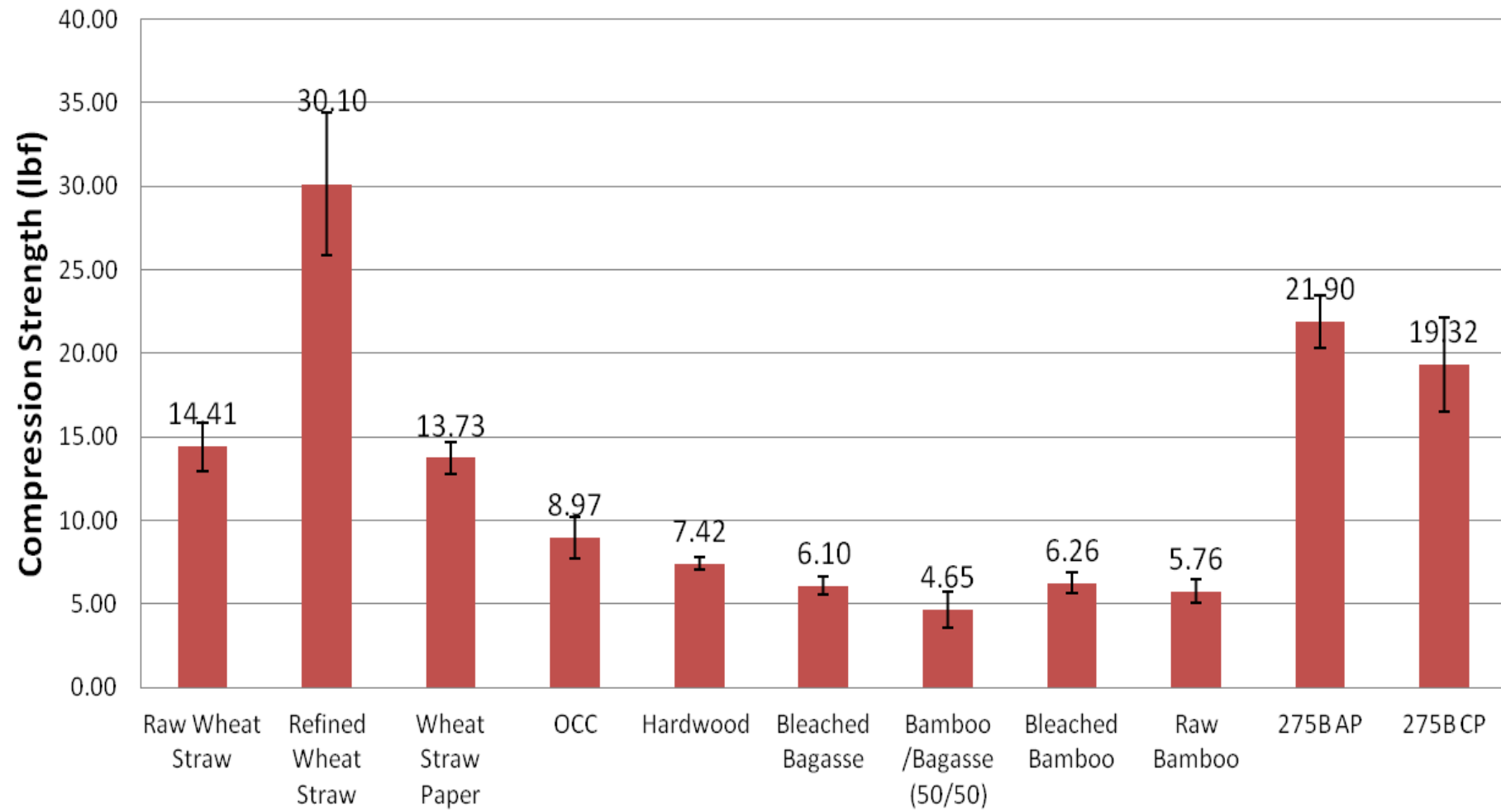
# Arundo Photomicrograph



## Bending Strength Test



## Compression Strength Test



# Oil and Water Resistance

	T1602 Control	T1607 Wheat Straw / 50% OCC	T1608 100% Wheat Straw	T1609 5% Wheat Straw / 50% Semi-Chem / 45% OCC	T1610 10% Wheat Straw / 45% Semi-Chem / 45% OCC	T1611 25% Wheat Straw / 30% Semi-Chem / 45% OCC	T1612 Control
Oil Drop, sec. - Top Avg.	90	348	960	142	156	180	118
Oil Drop, sec. - Top % difference from Control.		194.9%	713.6%	20.3%	32.2%	52.5%	0
Oil Drop, sec. - Bottom Avg.	108	455	986	154	158	215	123
Oil Drop, sec. - Bottom % difference from Control.		269.9%	701.6%	25.2%	28.5%	74.8%	0
1" Water Drop, sec. - Top	31	37	60	23	24	24	36
1" Water Drop, sec. - Top % diff. from Control		2.8%	66.7%	-36.1%	-33.3%	-33.3%	0
1" Water Drop, sec. - Bottom	36	44	122	27	27	26	41
1" Water Drop, sec. - Bottom % diff. from Control		7.3%	197.6%	-34.1%	-34.1%	-36.6%	0

# Papermaking Concerns

- ▶ Higher WRV than dried virgin wood pulps
  - ▶ Longer to dry
- ▶ WRV better than ONP
  - ▶ Faster to dry
- ▶ Higher fines content in some species
  - ▶ Potential for additional wet end chemistry except sizing and grease proofing in unbleached pulps
- ▶ Drains better than ONP

# Wet End Chemistries Used

- ▶ Sizing Agents, normally AKD
- ▶ Grease proofing agents
- ▶ Wet strength
- ▶ Retention and drainage aids

# Summary

- ▶ Molded Pulp operations are very similar to traditional papermaking
- ▶ Nonwood fibers work as well if not better than wood fibers
- ▶ Nonwood fibers work as well if not better than most recycled fibers
- ▶ Nonwood fibers can enhance the final product in a variety of ways