New VN. Old Mills – Assessments of Recycled Paper Products Between US and China

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Highlights
- China applied 63% recycled fiber in all paper products. Recycled fiber can produce quality products.
- China mills kept positive on market demands and facility investments.
- Newsprint and paperboard containing recycled fiber from U.S. & China mills are investigated, strength and weakness seen on both sides.
- Recycled fiber applied in U.S. mills has better quality than those in China peers.
- U.S. is good on paper recycling, but weak on recycled fiber utilization.

Introduction
The Facts of Pulp and Paper between U.S. and China
- China becomes the largest paper/board manufacturer, both capacity and productivity are still increasing.
- U.S. paper/board capacity and productivity were keeping shrinking since late 1990's.
- Chinese has extremely low natural resources in terms of per capita.
- Paper recycling is the most successful sustainable program in U.S.
- U.S. has advantages in manufacturing experiences and techniques, and China has advantages in new facilities and processes.

Methods
Paper machine average ages, years
New PM installations, 2000-2010
Forest cover
Domestic consumed paper/board recycled
Recycled paper for export
Recycled fiber in all new paper products

Note: Data are cited in 2010 and 2011; NA refers US and Canada

Attitudes on Recycled Fiber Utilization
- Recycled fiber is the largest fiber source in China, up to 63%. U.S. only applied 37% recycled fiber into new paper products.
- China applied recycled paper in all grades of products, U.S. only focus on paperboard, tissue, newsprint.
- U.S. exports 42% of recycled paper in 2011, and is the largest recycled fiber supplier to China.

Methodology
Sample Sources
- Newsprint paper (NP) and one-side coated paperboard (PB) samples were coming from four mills in both U.S. and China.

Fiber Analysis
- Recycled fibers (tinted) were found under 50X microscope.

Optical Properties and Lightfastness
- All newspapers have closed optical properties, e.g. brightness, gloss and CIE L*, a*. UNP shows yellowish tint.
- No Fluorescence is found in all of samples.
- UNP has poor lightfastness, which indicates high lignin content. Virgin pulp is included.

Results and Discussions
Fiber Analysis
- Recycled fibers were found under 50X microscope.

Ash content, pH and electrical conductivity
- UNP applies near double mineral pigments percentage (e.g. CaCO3) than those in UPB so that it reduces the paperboard functional properties.
- UNP solution shows acid that it indicates an outdated papermaking process; CNP is made in alkaline environment.
- UNP and UPB have high electrical conductivities. It refers high level impurities in pulp, or poor washing effectiveness.

Fiber quality assessment
- All fibers are short and straight.
Fibers from U.S. mills are longer and wider, indicates Chinese mills use lower grade fiber.
Zero span tensile indicates the mills in China uses additional binders to offset fiber weakness.
- Fiber length (weighted, mm)
Fiber width (mean, micron)
Curl index (Arithmetic)
Kink index (1/mm)
Zero span tensile (corrected, N/cm)

Reaction absorption and stretch are still decreased.
UNP can offsets the loss of tensile strength. However, the tensile energy absorption (REA, or toughness) and stretch remain increased.
- High filler contents decrease mechanical properties. Long fiber in UNP has high bulk and caliper which are good on readability.
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China applied 63% recycled fiber in all paper products. Recycled fiber is the main fiber source of China pulp and paper industry.
- China mills apply 100%, relative low grade recycled fiber produces quality paper products.
- U.S. has very good paper recycling program, but need to invest on recycled paper utilization.
- U.S. mills need to find solutions to overcome current facility shortage, especial for recycled paper.

Conclusions
- Recycled fiber is the main fiber source of China pulp and paper industry.
- China mills apply 100%, relative low grade recycled fiber produce quality paper products.
- U.S. has very good paper recycling program, but need to invest on recycled paper utilization.
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