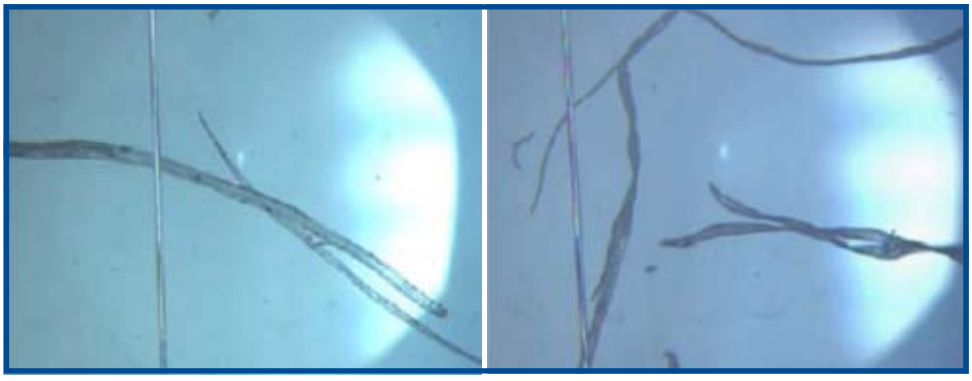
Preventing Strength Loss of Unbleached Kraft Fiber

Treatment of Never-Dried Fibers Will Lead to Energy Savings and Improved Paper Quality

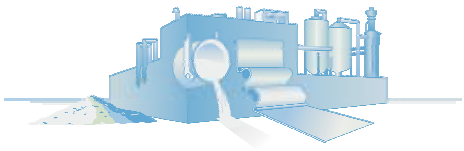
The reuse of old corrugated containers (OCC) as fiber feedstock reduces net energy use when compared to use of virgin fiber and keeps OCC out of landfills. The pulp and paper industry would like to increase the domestic recycling rate of OCC, increase the recycled fiber content, reduce the weight, and/or reduce the variability of recycled paperboard. However, it must first overcome the irreversible loss of strength that occurs to the kraft pulp during its first exposure to the refining, pressing, and drying operations associated with paperboard manufacture. These changes reduce the bonding potential of the fibers and make it less economical to recycle kraft paperboard for subsequent paperboard production.

Researchers explored methods to prevent the loss of bonding potential in kraft pulp by treating it before it is used to manufacture paperboard. They looked for simple chemical treatments using non-toxic products that require few changes in a plant's capital equipment.

The new technology will benefit industry by increasing the recycling of paperboard, lowering net energy use, and reducing the amount of chemicals or basis weight required to meet the strength specifications for the product.



Never-dried fiber (left) and oven-dried fiber (right) show twisting and loss of strength due to drying of kraft pulp fibers.



Benefits for Our Industry and Our Nation

- Increased recycling rate of kraft fiber-based paperboard
- Reduced net energy use
- Increased value of OCC as source of secondary fiber
- Decreased landfilling of OCC
- Lower use of chemicals
- Reduced basis weight needed to achieve strength specifications

Applications in Our Nation's Industry

The project will be beneficial to integrated paper mills by increasing the strength of their product and reducing its variability. Treatment of never-dried fibers will lead to energy savings and improved paper quality.

Project Description

Goal: To identify the chemical conditions that interrupt or compensate for the loss of strength in never-dried kraft fibers when they are formed into paper for the first time.

Researchers looked for low-cost techniques of blocking the chemical mechanisms that cause strength loss in fibers. They used never-dried, unbleached kraft fibers for most of their investigations. Selected experiments were conducted on commercial secondary OCC pulp obtained from a paper machine producing secondary linerboard.

The first phase of the effort was a screening of various chemical treatments to determine their effect on the dry strength of handsheets formed from never-dried pulp. Products evaluated included guar, starch, acrylamide, urethane, surfactants, dye-analogues, and enzymes. Variables included dosage levels, time of exposure, and degree of agitation. In the second phase, these sheets were compared to recycled paper with paper formed after repulping and repeating the forming and drying processes. Variables included freeness, water-retention value, fiber length distributions, and colloidal charge.

Results

- The loss of bonding ability was associated with effectively irreversible closure of porosity within the cell walls of the fibers; it was possible to partly block such loss of porosity by drying the fibers in the presence of concentrated sugar solutions.
- Conditions of pH and refining history did not appear to play significant roles relative to strength loss or pore closure within the ranges typically encountered in containerboard production.
- Certain polymeric additives, when added to never-dried, refined kraft fibers, produced strength benefits for both the initial paper and recycled paper produced from the same fibers with no further chemical treatment.
- Flexibility of wet fibers is highly correlated with the resulting paper strength; however, flexible fibers tend to lose their flexibility upon drying.
- Additional refining appears to be one of the most promising ways to restore bonding ability to kraft fibers, though each application of refining tends to make the resulting paper web harder to dewater, often requiring a slower rate of production.

Project Partners

North Carolina State University
Department of Wood & Paper Science
Raleigh, NC

Hercules Incorporated
Wilmington, DE

International Paper
Tuxedo, NY

For additional information, please contact

Drew Ronneberg, Ph.D.
Industrial Technologies Program
Phone: (202) 586-0205
Fax: (202) 586-9234
E-mail: Drew.Ronneberg@ee.doe.gov

Martin A. Hubbe, Ph.D.
Department of Wood & Paper Science
North Carolina State University
Raleigh, NC 27695-8005
Tel.: (919) 513-3022
Fax: (919) 515-6302
E-mail: m hubbe@ncsu.edu

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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