Development of Screenable Wax Coatings and Water-Based Pressure Sensitive Adhesives

New Screenable Wax Coatings and Adhesives Will Improve Paper Production from Recycled Fibers

Pressure sensitive adhesives (PSAs) are used in many applications, including stamps, mailing labels, self-adhesive notes and tape, and glues for sealing boxes. Wax coatings are used in making treated paper containers, such as shipping cartons for agricultural products. When these products are part of the recovered paper stream, they create a number of problems for a recycling pulp mill, including lost production and diminished product quality. Currently, wax-coated containers are not normally accepted by recycling mills due to the problems they create, which means that about 1.3 million tons of high-grade paper goes to landfill each year rather than to a recycling facility.

This project is focused on developing PSAs and wax coatings that can be easily removed by screens early in the paper recycling process. In a prior project, researchers developed improved thermoplastic (hot-melt) PSA formulations that manufacturers are now incorporating into commercial product lines. The next target is emulsion or water-based PSA, which is more complex than the hot-melt glues, but composes approximately 80% of the worldwide PSA label market. Researchers will apply the knowledge and modeling tools developed for hot-melt PSAs to solve the problems presented by water-based adhesives. In addition, the project will research new technologies for making screenable wax coatings.

EnviroSensitive PS Label Line (image provided by Avery).

Benefits for Our Industry and Our Nation

Substitution of current water-based PSAs and moisture barrier coatings with screenable versions will save an estimated 10 trillion Btus (British thermal units) per year (1.71 million barrels of oil) in energy. It will also greatly increase the amount of paper that can be recovered for recycling—an increase of 6 percent for old corrugated containers (OCC) recovery alone. The elimination or reduction of waxes and adhesive contaminants from recycled pulp will also reduce process problems and the production of off-spec products, which currently cost the paper industry more than $700 million annually.

Applications in Our Nation's Industry

Screenable water-based PSAs and wax coatings can be used with all materials marketed for use with paper products, and would increase the quantity and quality of recycled paper.

Project Description

The goal of this project is to design new formulations and production processes for water-based adhesives and wax coatings that can be easily screened from recycling operations. This project will use the knowledge and resources developed in a previous project, "Development of Screenable Pressure Sensitive Adhesives," which ended in August 2003 and focused primarily on thermoplastic, or hot-melt, PSA technology. The researchers of this new project will apply the expertise and modeling tools from the hot-melt PSA research to develop commercially viable, screenable water-based PSAs and wax coatings.

Barriers

- Imparting the appropriate properties to water-based PSAs and wax coatings without increasing costs or sacrificing performance
- Formulating and characterizing model systems to identify the components that govern critical properties, specifically which components govern fragmentation during repulping and subsequent removal efficiency via screening
- Identifying any differences in fragmentation behavior between hot-melt and water-based PSAs through repulping studies
- Examining the role of processing (e.g., formulation, coating, drying) on properties controlling removal efficiencies

Progress and Milestones

- Characterized and tested removal efficiencies of existing commercial products (Completed October 2005)
- Characterize and test removal efficiencies of new model water-based PSAs
- Develop and test new commercially viable PSAs and wax coatings at laboratory- and pilot-scales
- Develop new benign commercial treated corrugated containers

Commercialization

Project partners, including Boise Cascade and Franklin International (a global distributor of adhesive products), will use the results to develop and introduce screenable PSA product lines; other companies can follow suit using the published results of the project. For the wax coating formulations, the International Group (which supplies over 15% of the waxes and wax

Project Partners

University of Minnesota
Twin Cities Campus

USDA Forest Service
Madison, WI

Franklin International
Columbus, OH

The International Group, Inc.
Toronto, Ontario, Canada

Boise Cascade Corporation
International Falls, MN

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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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