Innovative Approach to Solving "Stickies" Problem and Developing Environmentally Benign Pressure Sensitive Adhesives Through Partnerships

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ABSTRACT

As a result of a United States Postal Service (USPS) initiative, a work team consisting of the USPS, the Forest Products Laboratory (FPL), Springborn Testing and Research (STR), and industry representatives was formed. The industry representatives include papermakers, paper recyclers, paper collectors, equipment manufacturers, paper users, and adhesive and chemical suppliers. The objective of the work team is to develop new and innovative solutions to the problems associated with recycling recovered paper containing pressure-sensitive adhesives (PSAs). Initial open discussions were held at USPS-sponsored conferences during 1995-1997, followed by work team meetings, also organized by the USPS. As a result of this collaboration and based on the criteria set by the paper industry, the adhesive industry is formulating new PSAs that are mostly removable in the screening stage of the recycling process. As a result of these combined efforts, protocols were developed to evaluate the newly developed adhesives. This paper outlines a pilot-scale separation sequence to assess the removal of contaminants from the feed stock containing PSAs. The sequence involves high consistency pulping, pressure screening, forward and reverse cleaning, and washing and flotation deinking. The protocols simulating typical recycling operations and using preconsumed, postconsumed, and control stocks were further refined to reflect optimum operating conditions, such as temperature, consistency, screen size, and repulping energy. Fourteen newly formulated adhesives were evaluated using this pilot-scale protocol

INTRODUCTION

Removing contaminants from recovered paper pulps is one of the biggest environmental challenges facing the paper industry. It is also one of the major technical barriers to paper recycling. Despite the advances made during the past few years, contaminants from adhesives are a major problem during both the processing of recovered paper and the papermaking operation. The contaminants from adhesives are called stickies by papermakers, because they stick to paper machine felts and wires and cause many operating problems, including breakdowns. Stickies are an undesirable recovered paper component that comes from pitch, ink, plastic films, converting aids, paper coating, and adhesives. Adhesives are either hot melt or pressure sensitive. Pressure sensitive adhesives (PSAs) come from products such as labels, tapes, and some postal materials. There are several methods of quantifying stickies, and there is no agreement on one standard method.

The USPS currently purchases about 12% of the domestic PSA production As a result of a USPS initiative, a team consisting of the USPS; the USDA Forest Service, Forest Products Laboratory (FPL); and industry representatives (papermakers, paper recyclers, paper collectors, equipment manufacturers, and adhesive and

chemical suppliers) is working cooperatively to help solve the problem of PSAs in recovered paper. The team's goal is to work with the industry to develop new environmentally benign PSAs for postal applications that will fulfill USPS specifications and be compatible with the USPS environmental strategic plan. Environmentally benign PSA is a form of adhesive that places no significant additional burden on plants that are using recycled papers. It is hoped that this new PSA can be widely used in labels and stickers, for example.

The main objective of the USPS's program for environmentally benign PSAs is to develop postage stamp adhesives that do not adversely affect the environment. The goal is to develop PSA stamp products that can be successfully recycled into paper products in a typical recycling facility, particularly those plants supplying pulp for printing and fine grades of paper. This paper describes some of the program's major issues, team efforts, and final products.

DISCUSSION

Despite the fact that PSA stamps are very popular with the general public, there are some serious concerns regarding their environmental impact. To address these concerns, the USPS in conjunction with FPL, STR, and paper industry representatives, organized several national PSA meetings to incorporate the input of the adhesive manufacturing industry and the paper manufacturing industry (1,2,3). The issues raised and discussed included defining the problem, communication, education, source quality control, recyclability standards for PSAs, paper industry perspective, end-product specifications, and the role of technology. The meetings concluded that problems caused by stickies are best resolved through combined efforts of the adhesive industry, the paper industry, and the process equipment manufacturers.

Keeping in mind the criteria set by the paper industry, the adhesive industry is striving to formulate new PSAs that are mostly removable in the screening step. This work team met several times to discuss and decide on the image analysis and pilot plant testing protocols to use to evaluate the newly produced adhesives on a small scale. The team agreed that there is a need for a standard method for testing, a lack of information on the removal efficiencies during recycling unit operations, and a need to develop a reasonable method that combines pilot testing and image analysis.

As a result of all these combined efforts, a pilot-scale separation sequence was developed to assess the removal of adhesives from the feed stock containing PSAs. This pilot-testing protocol simulating a typical recycling operation included high consistency pulping, coarse and fine pressure screening, forward and reverse cleaning, and washing and flotation deinking. Modified TAPPI standard dirt counts were developed, and handsheets were made from pulp samples after each unit operation and on paper samples from the paper machine runs. The protocols simulating typical recycling operations and using preconsumed, postconsumed, and control stocks were further refined to reflect optimum operating conditions such as temperature, consistency, screen size, repulping energy, and chemical additives.

Current efforts involve laboratory testing of commercially produced PSAs, stamp print and finish trials, mill-scale recycling trials, and development of the final specification and approved product list for PSA stamp production. In addition to being recyclable, the final specification includes stringent USPS performance requirements. These stamp requirements include permanent adhesion to envelop substrates and ability to withstand long-term aging (archive ability).

Results of this work team were presented by all participants at the 1998 TAPPI Recycling Symposium cosponsod by the USPS and FPL and held in New Orleans on March 8-12,1998 (4). In addition, invited presentations were given at the 1998 PIRA Deinking Conference in England (5) and the PTS/CTP Deinking Symposium in Germany (6). Plans are underway to present the final results of this project at the TAPPI Recycling Symposium to be held in Washington, DC, March 5-8,2000.

CONCLUSIONS

The cooperative partnership mode stemming from this research program has resulted in increased environmental awareness to resolve the PSA recycling issue. Benefits of this cooperative approach include new testing protocols defining the recyclability of PSAs and a wealth of information on the newly formed PSAs. It is anticipated and hoped that the results and recommendations resulting from this research program will apply to labels, stickers, and a wide range of similar PSA products.

Involving all parties concerned in defining and solving environmental problem has yielded great results and has proven to be an effective approach with practical results. Leadership is definitely needed to initiate and continue the process and to make it beneficial to all concerned parties

REFERENCES

1. Peng, et al, Proceedings of the USPS/Springborn Joint Conference Covering Environmentally Benign PSA for Postal Applications, Windsor, CT, 14 February 1995. U.S. Postal Service (1995).

2. Peng, et al. Proceedings of the USPS/AFPA Joint Conference on PSA Issues, Washington, DC, 25 June 1996, U.S. Postal Service (1996).

3. Peng, et al Proceedings of the Environmentally Benign PSAs for Postal Applications, Washington, DC, 7-9 July 1997, U.S. Postal Service (1997).

4. AbuBakr, Said et al Proceedings of the 1998 TAPPI/USPS/FPL Recycling Symposium, New Orleans, 9-11 March 1998, Tappi Press (1998).

5. AbuBakr, Said et al Proceedings of the 5th International Recycling Technology Conference, Brighton, England, 9-10 February 1998, PIRA (1998).

6. AbuBakr, Said et at Proceedings of the 1998 PTS/CTP Deinking Symposium, Munich, Germany, 6-8 May 1998, PTS/CTP (1998).

AbuBakr, Said; Peng, Joe. 1999. Innovative approach to solving “sticktes” problem and developing environmentally benign pressure sensitive adhesives through partnerships. In: Proceedings of the 1999 TAPPI international environmental conference; 1999 APRIL 18-21; Nashville, Atlanta, GA: TAPPI Press; Vol. 2; 763-765.