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RESEARCH ON FLAME RETARDANT BLENDS Since the "Tris" episode some years ago, there has been considerable interest in the development of fabrics made from flame-retardant fibers blended with others, both natural and man-made. Studies at the Textile Research Center have involved experimental flame-resistant fabrics using cotton blends. Results from these investigations have been interesting, and we would like to report flammability behavior of the experimental fabrics as determined by the Oxygen Index (OI) values and the thermal properties determined by the thermogravimetric analysis (TGA). The Oxygen Index value is the percentage of concentration of oxygen in a given mixture with nitrogen which will support sustained candle-like burning of a material and is calculated from the equation $OI = \frac{100 \times O_2}{O_2 + N_2}$

Thermogravimetric analysis provides a method for the determination of mass change in a polymer as a function of time and temperature. The TG curve gives information on the thermal stability and on the products formed on heating.

In previous work at TRC, Cordelan was used as a source of chlorine in blends with wool and cotton/polyester. Blends of PBI (Polybenzimidazole, the Celenese Corporation's high performance fiber) with other fibers such as wool, Nomex and polypropylene have been studied for their thermal characteristics by other researchers. However, very little information is available on the flammability behavior and thermal properties of fabrics made from cotton/PBI blends. Fabrics used in our investigations were knitted from rotor-spun yarns composed of cotton blended with PBI and with Cordelan. Properties of the fibers used were: Cotton - Pima 1¼ inches, 3.9 micronaire; PBI - 1½ inches, 2.0 denier; Cordelan - 1½ inches, 2.0 denier. The yarns were produced by blending light-weight (30 to 40 grains/yard) drawframe slivers at a rotor-spinning machine.

The actual compositions of the blends were determined from the moisture regain values of the nominal blends and their component fibers, conditioned at 65% RH and 70° to 75° F (21° to 24° C). Blend compositions were determined using the formula $X = Y \cdot W + (1 - Y)C$; where X = the moisture regain of the nominal blend; Y = weight fraction of one fiber; W = moisture regain of the same fiber; and C = moisture regain of the other fiber.

In this issue of *Textile Topics* we are reporting the Oxygen Index values and thermogravimetric analyses of cotton/PBI blends. Table I gives the nominal and actual blend compositions. The regression analysis in Figure 1 shows the coefficient of determination (r^2) equal to 0.999, which indicates excellent correlation between the moisture regain and the actual blend composition. Table II presents the Oxygen Index values. The OI values of the PBI-rich blends were about 4 units higher than the calculated ones. Usually the fabrics having 27 OI value passed the vertical flame test. However, the cotton fiber in the blend that had 36 OI value burned the entire length of the sample.

The experimental TG curve and the additive (calculated) curve of the 46/54 blend are shown in Figure 2. The additive curves were calculated by averaging the individual curves for the separate components. If there is no physical or chemical interrelation, the experimental and additive curves should coincide. The experimental TG curve is higher than the additive curve up to 450°C, and after 530°C the additive curve becomes higher than the experimental curve. PBI lowers the initial rate of decomposition of cotton, perhaps by absorbing heat, and the mass residue of cotton after complete decomposition accelerates the decomposition of PBI.

In a future issue of *Textile Topics* we will report the flammability behavior and thermal analysis of cotton/Cordelan blends. This study was sponsored at TRC by the Natural Fibers & Food Protein Commission of Texas and conducted under the supervision of Dr. R. D. Mehta, manager of the Center's special finishes research.

TABLE I

BLEND COMPOSITION of COTTON/PBI BLENDS by MOISTURE-REGAIN VALUES

Nominal Blend Composition		Moisture Regain	Actual Blend Composition (Calculated from Moisture Regains)	
Cotton, Y	PBI	%, X	Cotton	PBI
100	0	7.57	100	0
0	100	14.6	0	100
64	36	10.1	64	36
47	53	11.4	46	54
28	72	12.3	32	68

TABLE II

OXYGEN INDEX VALUES of COTTON/PBI BLENDS

Actual Blend Composition		Oxygen Index (OI) Value		
Cotton	PBI	Experimental	Calculated	Difference Between Experimental and Calculated
100	0	18.3		
0	100	38.3		
64	36	24.9	25.5	− 0.6
46	54	33.0	29.1	+ 3.9
32	68	36.0	31.9	+ 4.2

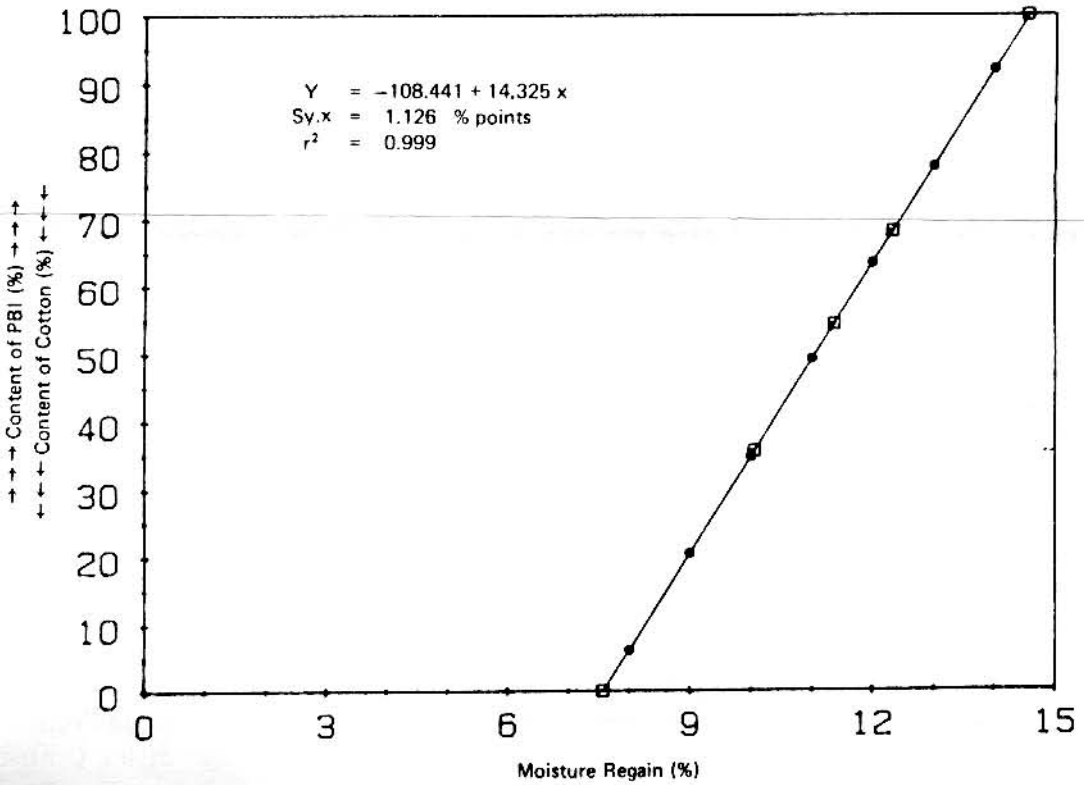

FIGURE 1: LINEAR REGRESSION OF COTTON/PBI BLEND COMPOSITION ON MOISTURE REGAIN

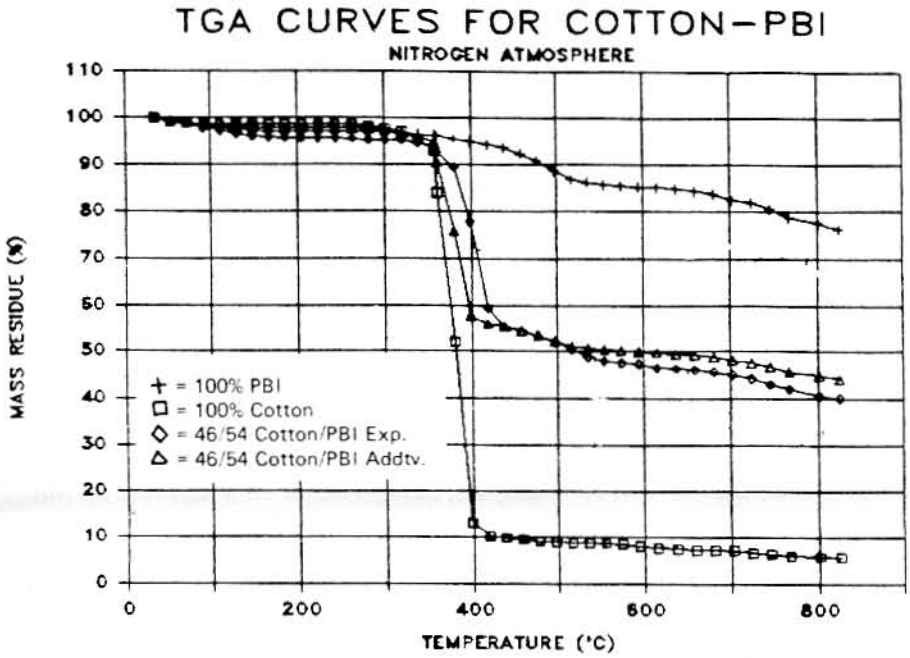

FIGURE 2: EXPERIMENTAL AND ADDITIVE TG CURVES OF 46/54 COTTON/PBI BLEND

CONFERENCE ON COTTON FIBER MATURITY On March 25 the Textile Research Center hosted a meeting on cotton fiber maturity which was attended by some two dozen individuals who have indicated interest in this subject. Nearly all of the discussion dealt with the use of the Technicon InfraAlyzer 400, an instrument designed to measure cotton fiber maturity as well as other characteristics of textile fibers.

The meeting served as a forum for reviewing the research done so far on this subject and gave an opportunity for presenting the status of industry's search for a rapid and accurate method of measuring maturity. Dr. Preston Sasser of Cotton Incorporated served as conference chairman. John B. Price reported on the research underway at the Textile Research Center which utilizes the InfraAlyzer. Subhas Ghosh of the Institute of Textile Technology, Charlottesville, VA, gave a report on the work done at that institution using the same instrument. Additional information was presented by Roy Weedon and Cynthia Kradjel of the Technicon Instruments Corporation. H. H. Ramey, Jr. and Devron P. Thibodeaux of the United States Department of Agriculture reported on past and current research to evaluate means of measuring cotton fiber maturity.

Attending the meeting in addition to those mentioned above were Dick Bassett, USDA Cotton Research Station, Shafter, CA; Charles K. Bragg, USDA Agricultural Research Service, Clemson, SC; H. B. Cooper, California Planting Cotton Seed Distributors, Research & Development, Shafter, CA; Jim Crawford, Spinlab, Gastonia, NC; Carl Cox and Jean VandeLune, Natural Fibers & Food Protein Commission of Texas, Dallas, TX; David Adams and Larry Teague, Motion Control Inc., Dallas, TX; Danny Davis and Joel Phillips, American Cotton Growers, Littlefield, TX; Jane Devers, Texas A&M Agricultural Experiment Station, Lubbock, TX; Joel F. Hembree, Lubbock, TX; Emerson Tucker, Plains Cotton Cooperative Association, Lubbock, TX; Paul McHugh, Crosrol Inc., Greenville, SC; Mike Nelson, All-Tex Seed, Levelland, TX; and five members of the Textile Research Center staff.

SULZER RUTI PRESENTS SEMINAR Howard L. Thomas, Jr. of the Sulzer Ruti Company in Spartanburg, South Carolina visited the Textile Research Center on April 16 and conducted a seminar on automation and robotics at weaving. His presentation included statistics on the improvement of production and efficiency at weaving due to recent developments in automation. The seminar was attended by staff of the Center and by students and faculty of the Department of Textile Engineering. Also, representatives of textile companies in the area participated in the meeting.

We were pleased to have Mr. Thomas visit with us and give us current information on state-of-the-art weaving.

VISITORS Visitors to the Textile Research Center in April, other than previously mentioned, included Wayman D. Gibson, Greenwood Mills, Inc., Greenwood, SC; Jerry Hyche, Greenwood Mills, Inc., Liberty, SC; N. Oliver Smyth, III, Smyth & Company, Montgomery, AL; George Ruppenicker and Patricia Bel, USDA, New Orleans, LA; Roger Bolick, Allied Plastics & Fibers, Hopewell, VA; Bob Rafferty, Texas Monthy Magazine, Austin, TX; Kathy and Gary Blackwelder, Boulder, CO; Richard Milligan, Murray-Carver, Inc., Dallas, TX; A. Illges, Jr., American Textile Marketing, Inc., Columbus, GA; Allan R. Anderson, San Matias Farms, Raymondville, TX; and Wayne Labar, Wayne Labar Farms, Rio Hondo, TX.

Also visiting were Barnett A. Greenberg, North Texas State University, Denton, TX; James King, Cone Mills Corporation, Greensboro, NC; Ed Hughes, USDA Ginning Research, Mesilla Park, NM; Jerry Harris, Mesa Gin, Lamesa, TX; Milton Hertz, U.S. Agricultural Stabilization & Conservation Service, Washington, DC; Barbara Shaeffer, Motion Control Inc., Dallas, TX; and Hans G. Reinhardt, Siegfried Peyer AG, Wollerau, Switzerland and his son, Stefan.