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RESEARCH ON FLAME RETARDANT BLENDS In the April 1986 issue of *Textile Topics*, we reported on the flammability behavior and thermal properties of cotton/PBI blends. We stated at that time that we would give information on cotton/Cordelan blends in a future issue, and now we would like to report the Oxygen Index (OI) value and thermogravimetric (TG) analysis of both cotton/Cordelan and cotton/Vinyon blends. Cordelan is a matrix fiber composed of 50% polyvinyl chloride (PVC) and 50% polyvinyl alcohol (PVA). Vinyon contains 85% PVC and 15% vinyl acetate. Since Vinyon contains substantially more PVC than Cordelan, we have believed it should be possible to increase the proportion of natural fibers in a blend with Vinyon for producing flame resistant fabrics, especially after application of antimony oxide.

The actual blend compositions of the fabrics were calculated from the moisture regain values of the pure fibers and their nominal blend percentages. The regression analyses in Figures 1 and 2 (see page 3) show the coefficients of determination (r^2) equal 0.999, which indicates excellent correlation between moisture regain and the actual blend composition. Tables I and II on the next page present the Oxygen Index (OI) values and the blend compositions of cotton/Cordelan and cotton/Vinyon, respectively. The OI values of the cotton/Cordelan blends increased as the Cordelan content increased. The difference between the experimental (actual) and calculated OI values decreased with an increasing Cordelan content. The 26/74 cotton/Cordelan blend with 27.0 OI value passed the vertical flame test. The 74/26 cotton/Vinyon blend gave a 20.8 OI value which was comparable to the OI value of the 69/31 cotton/Cordelan blend.

The experimental (actual) TG curves and the additive (calculated) curves of 70/30 cotton/Cordelan and 74/26 cotton/Vinyon blends in air atmosphere are shown in Figures 3 and 4 on page 3. Also included are the TG curves of the pure cotton, Cordelan and Vinyon fibers. The bicomponent characteristics of the Cordelan and Vinyon are obvious from the shape of the curves. Cordelan and Vinyon start to decompose around 250° C and lose weight rapidly between 251° C and 321° C. The decomposition slows between 320° C and 470° C and reaccelerates thereafter. The earlier portion of the curves could be ascribed to the decomposition of the PVC component in the Cordelan and Vinyon blends. Interestingly, the experimental curves of 70/30 cotton/Cordelan and 74/26 cotton/Vinyon are well below the additive (calculated) TG curves -- between 300° C - 320° C in the case of cotton/Vinyon and between 300° C - 380° C for cotton/Cordelan. This indicates that the heat and/or hydrogen chloride evolving from the decomposition of PVC accelerates the degradation of the cotton portion in the blend. Since the PVC component in the blends evolves hydrogen chloride prior to the decomposition-completed temperature of cotton, which is 390° C, an application of antimony oxide should be effective in increasing the flame resistance of cotton/Cordelan and cotton/Vinyon blends. Table III (next page) shows that a blend of cotton, wool, and only 5% Vinyon was rendered flame resistant by a formulation containing 3% antimony oxide solids, a latex, and a low temperature curing catalyst system. This was determined by the vertical flame test for 3-second ignition under bone dry conditions.

The use of Vinyon in blends containing cotton and/or wool may facilitate the production of flame resistant fabrics with an increased amount of natural fibers. This research is sponsored by the Natural Fibers and Food Protein Commission of Texas. It has been conducted at TRC under the supervision of Dr. R. D. Mehta with the assistance of Ali Salame and Dr. Radoslav Aleksic.

TABLE I

OXYGEN INDEX VALUES OF COTTON/CORDELAN BLENDS

Actual Blend Composition		Oxygen Index (OI) Value		
Cotton	Cordelan	Experimental	Calculated	Difference Between Experimental and Calculated
100%	0%	18.3		
0%	100%	31.4		
69%	31%	20.4	22.3	– 1.9
46%	54%	23.1	25.4	– 2.3
26%	74%	27.0	28.0	– 1.0

TABLE II

OXYGEN INDEX VALUES OF COTTON/VINYON BLENDS

Actual Blend Composition		Oxygen Index (OI) Value		
Cotton	Vinyon	Experimental	Calculated	Difference Between Experimental and Calculated
100%	0%	18.3		
0%	100%	37.0*		
93%	7%	19.0	19.7	– 0.7
91%	9%	19.2	20.0	– 0.8
88%	12%	19.0	20.5	– 1.5
74%	26%	20.8	23.1	– 2.3

*Hunter, L., "Textiles: Some Technical Information and Data III: Low Flammable and Other High Performance Fibers," SAWTRI Special Publication, July 1978, p. 9.

TABLE III

APPLICATION OF ANTIMONY OXIDE ON BLEND FABRICS

Blend Fabrics	Vertical Flame Test 3-Second Ignition: Bone Dry Conditions	
	Charlength (cm)	Afterflame Time (Seconds)
64/36 Cotton/PBI	(Cotton Portion)	
Untreated	BEL*	
Treated	1.4	1.9
70/30 Cotton/Cordelan		
Untreated	BEL*	
Treated	3.0	3.2
88/12 Cotton/Vinyon		
Untreated	BEL*	
Treated	7.1	0
44/51/5 Cotton/Wool/Vinyon		
Untreated	BEL*	
Treated	6.2	9.0
34/50/16 Cotton/Wool/Vinyon		
Untreated	BEL*	
Treated	3.4	0

*Burned to Entire Length

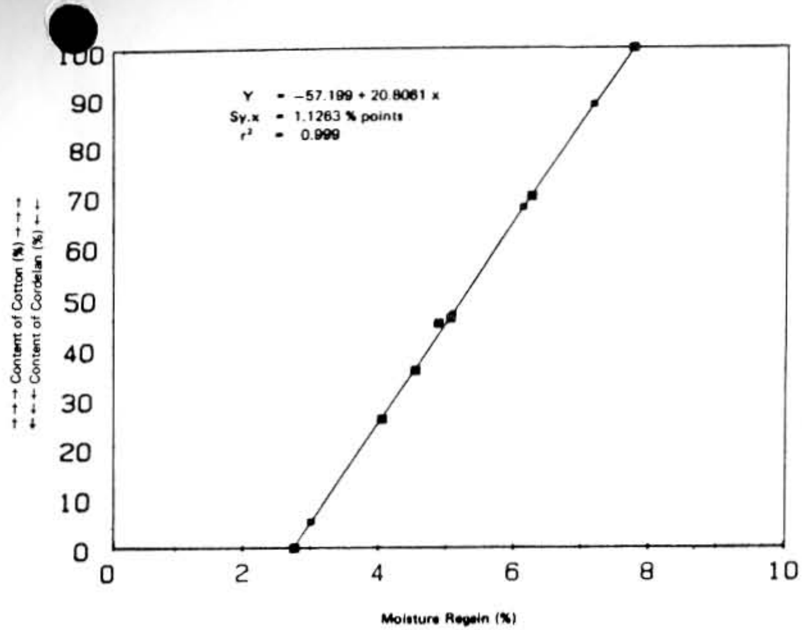

FIGURE 1: LINEAR REGRESSION OF COTTON/CORDELAN BLEND COMPOSITION ON MOISTURE REGAIN

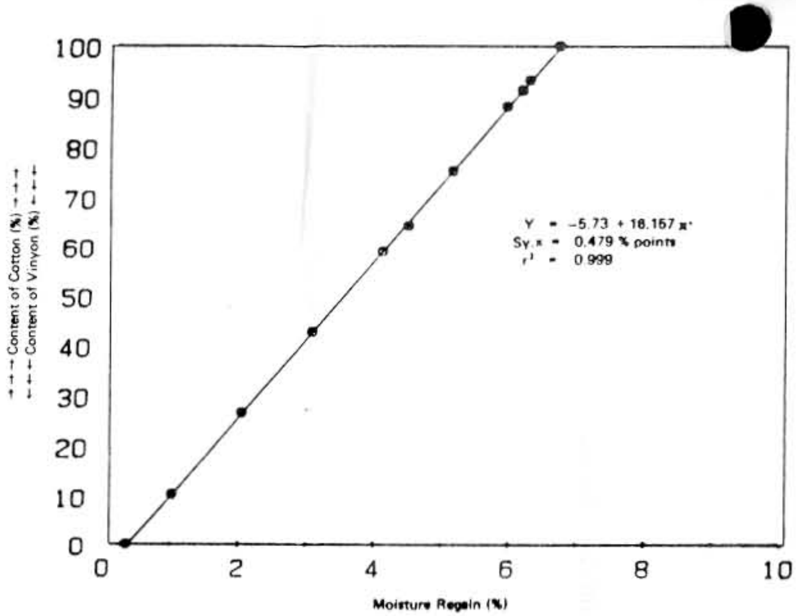

FIGURE 2: LINEAR REGRESSION OF COTTON/VINYON BLEND COMPOSITION ON MOISTURE REGAIN

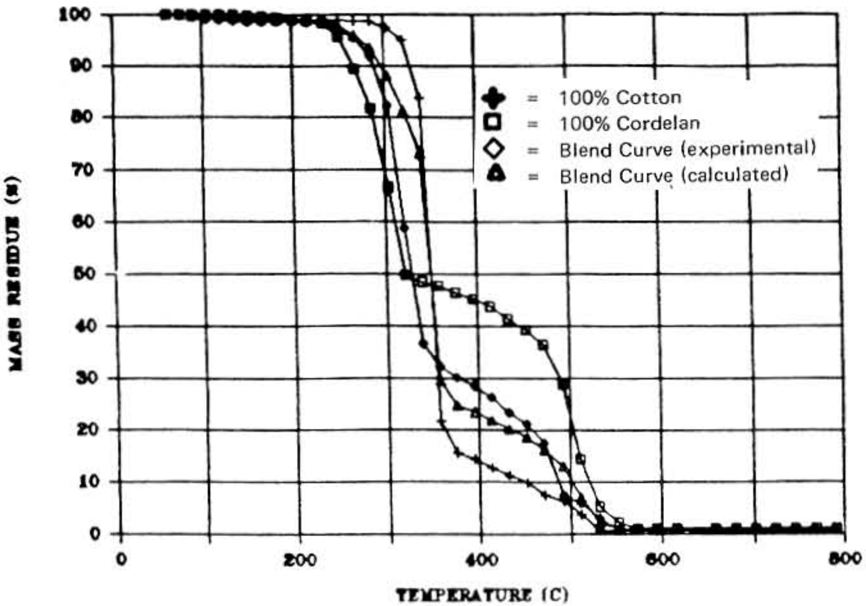

FIGURE 3: TGA CURVES FOR 70/30 COTTON/CORDELAN IN AIR ATMOSPHERE

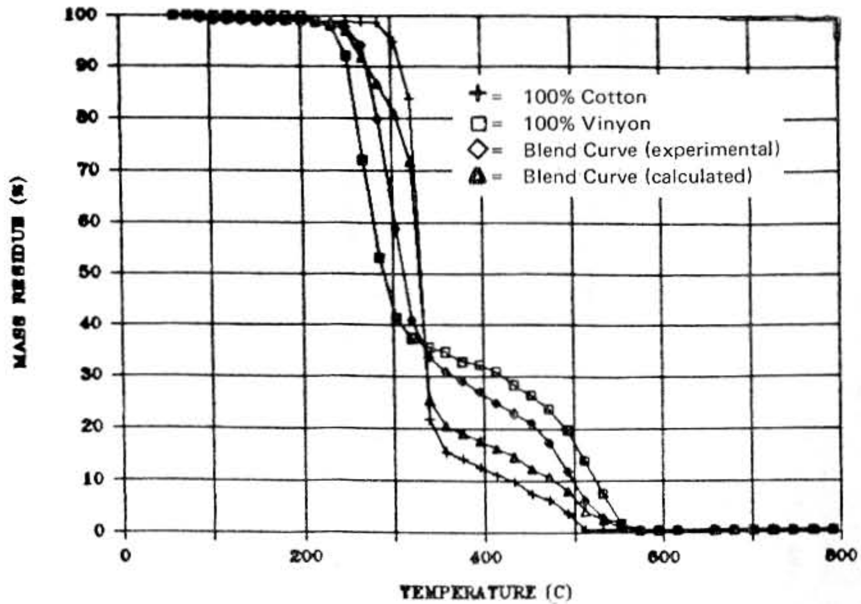

FIGURE 4: TGA CURVES FOR 74/26 COTTON/VINYON IN AIR ATMOSPHERE

TEXTUBE CORPORATION MAKES DONATION We were pleased to receive a donation of four cases of plastic cylinders and cones from the Textube Corporation of Greer, South Carolina. These are for use on our Rieter m1/1 and Schlafhorst Autocoro open-end spinning machines in both our academic and research programs. We have been using Textube products for some time, and we have always found them to perform remarkably well for different types and sizes of yarns at all speeds. Also, we appreciate the dimensional stability of these, for in our research we often have short spinning trials that necessitate their frequent reuse.

We are grateful to the Textube Corporation for its consideration of our needs here at Texas Tech University. This donation is most helpful and greatly appreciated.

STUDENT HONORS Just prior to graduation each spring, Texas Tech's Department of Textile Engineering presents an award to the outstanding senior. This is done in the name of L. E. Parsons, who was a professor of Textile Engineering on the faculty of Texas Tech University for some thirty years. This year, we found there were two seniors with excellent records. Therefore, it was decided for the first time to present dual honors.

The outstanding seniors in the Class of 1986 were Andrew L. Talbott and Keith D. Soechting. Both had high grade-point-averages and have displayed leadership ability throughout their years of study. We are pleased to have had Andy and Keith as students, and we extend our best wishes to them for much success in the textile industry.

VISITORS Recent visitors to the Textile Research Center have included John P. Gorman, Globe International Inc., Houston, TX; A. I. Smith, Jr., Covington & Smith Cotton Co., Norway, SC; W. S. Hamer, Dyesburg Fabrics Inc., Dyesburg, TN; Tom Vernon, Burckhardt America, Inc., Greensboro, NC; Tom Wallace, Anacacho Petroleum, San Antonio, TX; Charles Scruggs, Progressive Farmer, Austin, TX; and Jimmy Powell, American Wool & Mohair Association, Fort McKavett, TX.

Also visiting were Helmut Deussen, American Schlafhorst Company, Charlotte, NC; Yuji Watanabe, Toyoshima America, Inc., Fresno, CA; Takashi Shimazaki, Toyoshima & Co., Ltd., Nagoya, Japan; Wali M. K. Mazari, Sadiqabad Textile Mills Ltd., Karachi, Pakistan; and Habib R. Khan and Tariq Khan, Albuquerque, NM.