Project Title: Spinning of Fire Retardant Fibre Blends on Cotton System

Date of commencement: October 2009

Date of completion: September 2011

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Background :

Fire remains a common cause of death and injury. In major industrial cities around the world, it is responsible for 10-20% deaths and 100-200 injuries per 1mn inhabitants every year.

Worringly, fires in building are set to become more hostile in future as a result of increased insulation.

In many fires, the accidental ignitions of textiles is the major cause of fatalities. Furthermore, the most serious burn injuries are usually caused by the igniting or melting of clothing and the fusing of clothing to the skin rather than the fire itself.

Consequently, there is a strong need for flame resistant fabrics, which provide valuable protection against injury or death.

Flame resistant fabrics are not designed to preserve fabric integrity, but to reduce the spread of flames once they ignite. This reduction provides a substantial increase in the time available for the wearer to escape from a hazardous situation and avoid burn injury.

Flame resistant fibres and fabrics are used in the manufacture or garment for protection in environments where there are hazards such as fires, electric arc discharge and molten metal splashes.

The use of flame resistant garments has increased over the years as a result of stricter regulations regarding fire safety and greater comfort level. In turn, the growing use of flame resistant garments has led to a drop in the number of fire related injuries and deaths.

That said, the number of such injuries is still relatively large and there is therefore a strong case for further development of technologies which are capable of making flammable materials flame resistant. In addition, there is an urgent need for the development of new, more effective and

environmental friendly flame retardant, given growing concerns about the toxicity of some chemicals which are still widely used to impart flame resistance.

Main Aim of the Project:

To develop a cost effective Industrial Workwear

ATIRA Developed Workwear

Outcome of the Projects:

Two fabrics were developed from inherent Fire retardant fibres. The fabrics were compared with standard market products. Analysis and comparison of developed products and market products is as below:

Test Parameters		Fabric Code/Type				
		A1	A2	Standard 98% Aramid Fabric + 20% Antistatic Fabric	Standard 50/50 % Aramid / FR Viscose	Cotton Treated
GSM of Fabric		219.3	170.0	171.05	208	187
Flammability	Limited Flame Spread (As Received) Procedure A	- No Top or either edge flaming - No hole Formation - No flaming or Molten Debris - No after flame and after glow Pass A1 (Pass A1)	- No Top or either edge flaming - No hole Formation - No flaming or Molten Debris - No after flame and after glow Pass A1	- No Top or either edge flaming - No hole Formation - No flaming or Molten Debris - No after flame and after glow Pass A1	- No Top or either edge flaming - No hole Formation - No flaming or Molten Debris - No after flame and after glow Pass A1	Fail
	Limited Flame Spread (After Pretreat-ment) Procedure A	- No Top or either edge flaming - No flaming or Molten Debris - No hole Formation - **Avg after flame for 1 sec both in warp and weft direction** - No after glow **Pass A1**	- No Top or either edge flaming - No hole Formation - No flaming or Molten Debris - No after flame and after glow **Pass A1**	- No Top or either edge flaming - No hole Formation - No flaming or Molten Debris - No after flame and after glow **Pass A1**	- No Top or either edge flaming - No hole Formation - No flaming or Molten Debris - No after flame and after glow **Pass A1**	Fail
	Limited Flame Spread (As Received) Procedure B	- No Top or either edge flaming - No flaming or Molten Debris - No after flame and after glow **Pass A2**	- No Top or either edge flaming - No flaming or Molten Debris - No after flame and after glow **Pass A2**	- No Top or either edge flaming - No flaming or Molten Debris - No after flame and after glow **Pass A2**	- No Top or either edge flaming - No flaming or Molten Debris - No after flame and after glow **Pass A2**	Fail
	Limited Flame Spread (After Pretreat-ment) Procedure B	- No Top or either edge flaming - No flaming or Molten Debris - **Avg after flame for 2 sec both in warp and weft direction** - No after glow **Pass A2**	- No Top or either edge flaming - No flaming or Molten Debris - No after flame and after glow **Pass A2**	- No Top or either edge flaming - No flaming or Molten Debris - No after flame and after glow **Pass A2**	- No Top or either edge flaming - No flaming or Molten Debris - No after flame and after glow **Pass A2**	Fail

Test Parameters		Fabric Code/Type				
		A1	A2	Standard 98% Aramid Fabric + 20% Antistatic Fabric	Standard 50/50 % Aramid / FR Viscose	Cotton Treated
GSM of Fabric		219.3	170.0	171.05	208	187
Heat Resistance	Convection Heat Resistance HTI (24) in Sec	4.6	4.2	4.3	4.7	4.1
	Radiant Heat Resistance in Sec RHTI(24)	14.9	14.4	13.76	14.0	14.7
	Heat Resistance at 180^0C(After Pretreatment) in %	Warp = -2.80 Weft = -2.25 No charring, embitterment, ignition, melting, separation	Warp = -0.90 Weft = -0.85 No charring, embitterment, ignition, melting, separation	Warp = -0.50 Weft = -0.80 No charring, embitterment, ignition, melting, separation	Warp = -0.80 Weft = -0.90 No charring, embitterment, ignition, melting, separation	Warp=-0.58 Weft=-0.69 No charring, embitterment, ignition, melting, separation
Mechanical Parameters	Dimensional Stability to washing in % Warpway Weftway	 -2.15 +0.62	 -2.53 -0.55	 -2.66 -1.08	 -1.80 -0.85	 -5.24 -0.57
	Tensile Strength in Newton Warpway Weftway	 659.6 593.6	 543.31 437.14	 1057.97 795.63	 897.41 723.30	 750.0 320.0
	Tear Strength in Newton Across Warp Across weft	 16 15	 27 23	 82 70	 34 32	 15 14
	Seam Strength in Newton Warpway Weftway	 319.4 289.5	 310 295	 350 300	 300 290	 270 250
Air permeability		49.45	259	121.17	89.95	185.0
Durability of FR Properties		Till garment life	Till garment life	Till garment life	Till garment life	Up to 25 washes
Estimated Cost (Rs. Per mtrs)		375	500	1500	900	200

Conclusions summarising the achievements and indication of scope for future work: From the study, following major conclusion can be drawn.

Spinning of Inherent fibres on cotton system is possible with few modification like long staple cradle, Spin finish application etc.

Fabrics made from a blend of two or more types of fibres do not burn in the same way as those made from just one of these fibres types and result can be to increase the risk of burn injury. Thus selection of fibres for blending is very important factor for development flame retardant fabrics.

In general, Fabrics made from inherently flame resistant fibres are more expensive than those treated with flame retardant. However, they tend to be more durable.

ATIRA-Jayshree Developed Fabrics are more cost effective among available standard Inherent flame retardant fabrics

The developed fabrics can be used in wide range of application like

- Oil Refineries
- Gas company
- Automotives
- Welding apparel
- Metal Industries
- Airport Authorities

From the limited study of various Inherent flame retardant fibres, it appears that there is a good potential for development of cost effective FR protective work wear.

Publications:

Study of Heat and Flame properties of fabrics developed from various Inherent Flame Retardant fibres blends; presented at 52nd Joint Technological Conference of ATIRA, BTRA, NITRA and SITRA, held at Coimbtore, on 30th July, 2011

Spinning of Fire Retardant Fibre Blends on Cotton System; presented at 53rd Joint Technological Conference of ATIRA, BTRA, NITRA and SITRA, held at Mumbai, on 17th February, 2012