

# Stay Safe in the Sun with UV Protective Finish

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## 1. Introduction

There is ever-increasing demand in the marketplace for lightweight apparel that offers protection to human skin. Looking beyond the physical appearance and feel of the fabric, today's end user demands a range of functionality in garments or textile materials. Due to this, clothing manufacturers are also focusing their attention on imparting performance and functional finishes to the fabric, in order to meet the requirements of the customer.

One such is a UV-protective finish, which helps in protecting the skin from the harmful rays emitted from the sun. Garment construction can also help to increase protection from solar radiation, by virtue of the fibre choice and construction, but that is not enough – so a chemical treatment is required to enhance the UV protection of the fabric.

The ozone layer in the atmosphere blocks the ultraviolet radiation emitted from the sun, and has always acted as a shield that prevents these rays from falling on the earth's surface. But now, due to the emission of greenhouse gases, which has led to the depletion of ozone layer, more of this harmful radiation is able to penetrate the atmosphere.

Ultraviolet radiation accelerates the physical and chemical deterioration

processes of polymeric substances, causing effects such as the fading of colorants, yellowing of cellulose, photo-oxidation of polyolefins, embrittlement of coatings, etc. Photo-degradation is observed in almost every plastic material upon prolonged exposure to sunlight, thereby restricting their application for outdoor use. The degradation can be minimised by using UV stabilisers, which dissipate the energy acquired from these ultraviolet rays in a harmless manner, thus protecting the material and being destroyed themselves in the process.

Sun protection involves a combination of sun avoidance and the use of protective garments and accessories. Reducing exposure time to sunlight, using sunscreens and protective clothes are the three ways of protection against the deleterious effects of UV radiation.

Clothing made from woven fabrics can provide convenient personal protection; however, not all fabrics offer sufficient UV protection. In general, deep-dyed fabrics perform best in this regard.

The large surface area or textile fabrics and their constituent fibres makes them susceptible to attack by UV radiation, which degrades the textile materials by stimulating excitation in some parts of the polymer molecule. Much depends on the

## Abstract

Protection of the skin against the action of solar radiation is a relatively a new buzz in textile finishing. Textiles are a second skin to humans, and are worn to safeguard the skin from external agencies like wind, water, sunlight, etc. Since not all textile substrates guarantee adequate protection, special finishes are required to enhance their properties. This article deals with one such finish, which may be applied to textile materials to protect the skin from harmful ultraviolet rays. Ultraviolet rays constitute a very low fraction of the solar spectrum but influence all living organisms and their metabolisms. These rays can cause a range of effects, from simple tanning to highly malignant skin cancers, if the subject is unprotected. UV protection textiles include technical textiles, various apparels, accessories such as hats or shoes, and shade structures such as umbrellas. This paper gives a technical brief description of a UV protective agent, developed by Sarex for cellulosic fabrics.



Work wear



Parasols



Active wear



Beach wear

type of fibre and its chemical structure. Natural fibres like cotton, silk and wool have a lower Ultraviolet Protection Factor (UPF) than synthetic fibres. Cotton fabric in a grey state provides a higher UPF because of natural pigments, pectins, and waxes. Dyed cotton fabrics exhibit higher UPF and undyed bleached cotton yields very poor UPF.

UVR attacks polyamides the most, by photo oxidation. The fabric loses its strength and its crystalline structure. Polyester, too, is affected by UV radiation, to the tune of 45-50% after 30 days of exposure. Polyester fibres absorb more in the UVA and UVB regions than aliphatic polyamide fibres. Bleached silk and bleached Polyacrylonitrile (PAN) show very low UPF of 9.4 and 3.9 respectively.

Understanding the requirements of today's generation and the urgency of protection against harmful UV radiation, Sarex has developed an ultraviolet protecting agent, Yuvi-Cell, for cellulosic substrates, which gives a very good sun protection factor.

Yuvi-Cell is a highly efficient UV protecting agent for cellulosic fabrics. Cellulosic substrates treated with Yuvi-Cell exhibit excellent ultraviolet absorbing properties,

which are also durable to home launderings. It can be applied on dyed fabrics with minimum shade change.

## 2. Application of Yuvi-Cell on Various Cotton Substrates

Various qualities of cotton fabrics were taken and padded with 70gpl Yuvi-Cell, adjusting the pick-up to 65-70% and maintaining the bath pH in the range from 5.0-6.0. These fabrics were further dried at 130-160°C.

### 2.1 Ultraviolet Protection Factor Testing

The UPF values of the unfinished and finished fabrics were measured using a Shimadzu UV-2600 series in the range of 280 to 400nm, Model UV-2600(A11665101436). The UPF values of each fabric were determined from the total spectral transmittance based on the AS/NZS 4399:1996 method. UPF was calculated using mean percentage transmission in the UVA region (315 to 400nm) and mean percentage transmission in the UVB region (280 to 315nm).

The fabric was rated according to an

Ultraviolet Protection Factor (UPF). UPF is like SPF, except UPF rates protection against both UVA and UVB. A technical textile with a UPF of 50 only allows 1/50th of the UV radiation falling on the surface of the substrate to pass through it. In other words, it blocks 98% of the UV radiation. Sun protection clothing is an easy and steadfast form of UV protection and so is becoming more and more fashionable.

## 3. Results and Discussion

A variety of cellulosic fabrics commonly used for apparel were selected, each of which had poor UPF. They were treated with 70gpl Yuvi-Cell and then tested for UPF. Results are summarised in Table 2.

The results in Table 2 show that the fabrics treated with Yuvi-Cell exhibited much better UPF than the unfinished fabrics. This is due to strong absorption and blocking of UV rays in the near UV region. Organic products like benzotriazole, hydro-benzophenone and phenyl-triazine are primarily used for coating and padding processes in order to achieve broad protection against UV rays. The UV protection offered by a textile material is a synergistic influence of chemical characteristics, physico-chemical type of fibre, presence of UV absorbers, construction of fabric, thickness, porosity, extension of the fabric, moisture content of the fabrics, colour and the finishing given to the fabric.

Finished fabric were also subjected to

UPF Rating	Protection Category	UV Radiation Blocked (%)
UPF 15 – 24	Good	93.3 – 95.9
UPF 25 – 39	Very Good	96.0 – 97.4
UPF 40 – 50+	Excellent	97.5 – 98+

Table 1: Grades and classification of UPF

Sr. No.	Colour	Finished	UVA 315-400nm	UVB 290-315mm	UPF 290-400mm
1	White	Unfinished	25.17	18.69	4.97
		Yuvi-Cell (70gpl)	5.02	2.05	48.71
2	Maroon	Unfinished	5.56	4.38	22.01
		Yuvi-Cell (70gpl)	1.75	1.12	87.61
3	Purple	Unfinished	6.22	2.94	28.78
		Yuvi-Cell (70gpl)	1.41	0.92	107.17
4	Blue	Unfinished	11.43	10.25	9.53
		Yuvi-Cell (70gpl)	2.99	2.09	51.26
5	Yellow	Unfinished	3.15	1.98	19.25
		Yuvi-Cell (70gpl)	2.26	1.61	59.28
6	Striped Shirting	Unfinished	12.28	8.36	11.56
		Yuvi-Cell (70gpl)	4.09	3.13	30.21

Table 2: UPF rating of various finished and unfinished cotton fabrics

	UVA	UVB	UPF
	315nm~400nm	290nm~315nm	290nm~400nm
Unfinished	11.56	12.28	8.36
Finished (Initial)	6.04	3.72	29.84
Finished after 15HL	3.82	2.83	36.11

Table 3: Durability of Yuvi-Cell finished cotton fabric

three accelerated home launderings using AATCC 61 2A. From Table 3 it is evident that the UPF of the fabric after 15 home launderings remains more or less the same.

#### 4. Conclusion

To cope up with the current scenario and meet the requirements of the customers, which are ever increasing, UV-protective finishes can be very important. People today

are more aware and concerned about health, and the purpose of clothing has changed to include enhanced performance qualities.

Recreational exposure accounts for most of the significant UVR exposure of the population, while occupational exposure is also significant. This necessitates the development of stronger UV absorbers, and therefore Sarex has developed a UV protective agent, Yuvi-Cell, which can

protect the wearer from harmful UV rays and also increase the life of clothing. It was also found that cotton fabric treated with Yuvi-Cell continued to show excellent ultraviolet protection after 15 home launderings.

We at Sarex Chemicals can be a specific solution provider to its customers to meet their requirements in various other aspects of functional finishing.

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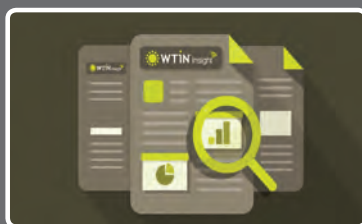
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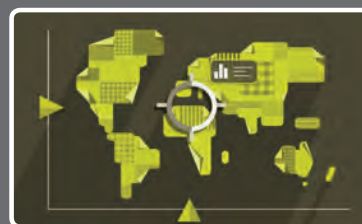
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