SGS CONSUMER TESTING SERVICES

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UV Protective Clothing

Over exposure to ultraviolet radiation (UVR) from the sun has raised considerable public health concerns. Consumers have an increased awareness of skin cancer, eye damage (such as cataracts) and premature skin aging; as a result they are looking for protection beyond sunscreens such as lotions and creams. Depletion of the ozone layer, which protects the earth's surface from harmful UVA, UVB and UVC rays, has forced the need for additional protection. UVA and UVB are the two classifications for solar radiation hitting the Earth's surface. UVA wavelengths are between 315 and 400nm and are most abundant at the earth's surface. Exposure to these rays results in premature aging, wrinkling and recently has been implicated as a cause of skin cancer. UVB wavelengths are between 280 and 315nm and are more dangerous than UVA rays yet less of them reach the earth's surface as most are absorbed by the ozone layer. UVB rays are a major cause of sun burn, skin cancer and cataracts. The third type, UVC wavelengths are between 100 and 290nm and are extremely dangerous but they do not reach the earth surface due to their absorption by the ozone layer.

Skin Cancer occurs mainly in people with fair skin, light eyes, and those who tend to freckle or burn easily during and after exposure to the sunlight. A history of having had 3 or more **sunburns** before the age 20, particularly **blistering sunburns** greatly increases risk of cancer. A history of severe sunburns in childhood and adolescence may actually double the risk of **melanoma** in adulthood. Statistics released by The American Cancer Society predict that more than a million people in the US will contract skin cancer in 2005 of which nearly 60,000 will develop Melanoma; a malignant tumour visible on the surface of the skin. In Australia, 1 in 30 people are expected to develop skin cancer at some time during their lives.

Clothing can provide a barrier against harmful rays; however it is important to understand that not all fabrics and garments offer equal protection. Australia was the first country to formalize UV protection claims for clothing and to develop a standard laboratory procedure for measuring the Ultraviolet Protection Factor (UPF) of fabrics and for labelling clothing according to a **UPF rating**. UPF is a measure of the UVR protection provided by a fabric. They also developed a rating scheme that categorizes products as good through excellent with a maximum rating of UPF 50+, although many fabrics can measure much more than this. To provide adequate sun protection, materials must have a minimum UPF of 15. In Europe, the UPF factor has to be in excess of 40 to comply with EN 13758-2.

UPF Range	*Protection Category*	*Effective UVR Transmission, %*	*UPF Rating*
15-24	Good Protection	6.7 to 4.2	15, 20
25-39	Very Good Protection	4.1 to 2.6	25, 30, 35
40 to 50, 50+	Excellent Protection	≤2.5	40, 45, 50, 50+

There are three standards used for determining Ultraviolet Radiation Factor for clothing manufactured for the USA market, two in Europe, and one in Australia;

- **AATCC 183** measures the amount of UV light transmitted or blocked by a fabric. The test is performed by exposing the fabric to ultraviolet radiation (UVR) and the amount of radiation passing through the fabric is measured. Samples are tested after conditioning in standard textile testing conditions. A minimum of 6 readings are taken from 3 specimens. Results are reported as UPF. The higher the UPF value, the more effective the sample is in blocking UVR and the better the sun protection it can give the wearer.
- **ASTM D6544** is a method for preparation of test samples prior to scanning for UV transmittance. Factors such as laundering, exposure to light, chlorinated pool water and perspiration can affect the amount of UV transmittance or blockage. Because laundering can change the UV blocking properties, the test samples must be tested in their original state and after 40 launderings.

- Labelling requirements are specified in **ASTM D6603**. Garments classified as good or better are labelled with the appropriate UPF value. Garments made of more than one fabric that have different UPF values, must be labelled using the lower value.
- **EN 13758-1** defines the method of test. It is based on the same principles as the American method shown above.
- **EN 13758-2** gives classification and marking criteria.
  Unlike the table in the US standard, there is only one label used in Europe (displayed right), so that an article either passes or fails the requirement; there are no grades of "pass".
- **AS/NZ 4399:1996** is a standard for evaluating fabrics and classifying sun protective clothing in order for consumers to make sound purchasing decisions.

There are several factors affecting the ability for a fabric to block UVR:

- **Fibre Content**: Different fibres such as cotton, polyester & nylon have different natural UVR absorbing properties.
- **Density** is probably the single most important factor affecting UV performance. The tighter the weave or knit, the less space there is between the yarns, therefore increasing the blockage of UVR through the fabric.
- **Colour** – Darker colours absorb more UV than lighter colours.
- **Stretching fabrics** increases the amount of UV transmitted by up to 40 %.
- **Condition:** If worn wet, as with swimwear for ex., the fabric will normally offer less protection than when dry.
- **Design and garment construction** play an obvious role in UV protection. A long sleeve shirt with a collar will offer more UV protection than a short sleeve shirt with no collar. Lined garments offer an additional layer of fabric for the rays to penetrate. Loose fitting clothing is more protective than tight clothes that conform to the body.

Fabrics that have a naturally low resistance to UVR can be treated with UVR inhibitors to improve the UPF ratings. Treatments with UVR inhibitors can be added to fibres and fabrics during manufacturing that bond with the fibres so they have good permanency and do not affect the original properties of the fabric.

Under different conditions, the original UPF rating can be altered. For example, garments that have no UV treatment may be improved simply by washing, which can improve the rating by compacting the yarns and reducing the area for UV transmission. However, after excessive washing, garments may become worn and threadbare and colours can fade, reducing the amount of protection. Garments with UVR treatment may worsen after repeated washings if the finish is not durable. The addition of UV finishes may have the added benefit of reducing fading and fabric deterioration.

The major forces driving the trend for UV protective clothing are attributed to reduction of the ozone layer, increase in skin cancer cases, and government legislation by other countries. Sun protective clothing is a selling point for outdoor items. Due to intensified competition, value added and differentiation is a means of success for some retailers. Functional aspects in some cases have replaced traditional values in the textile and garment industry.
Sun protective claims on garments must be supported by substantiating data. It is the responsibility of the manufacturer and retailer to use the proper rating on hangtags and labels.

In 1996 Australia published a standard for Sun Protective Clothing – Evaluation and Classification (AS/NZ 4399:1996). This standard provides information to consumers on how clothing can protect the skin against solar ultraviolet radiation. Currently in Europe, work is being done to formulate a similar standard for headwear (hats) so that the wearer can get an idea of the amount of protection afforded by their chosen headgear.

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