ARMADILLO
MERINO

PROTECTION

UV PROTECTION

This fact sheet outlines the UV protection properties of ZQ Merino

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# UV PROTECTION

# INTRODUCTION

Sunlight is an essential prerequisite for life on earth. The shortwave component of sunlight, ultraviolet (UV) radiation is beneficial to human beings in small doses, however larger doses can become a significant problem causing erythema (sunburn), skin cancer, photo keratitis and cataracts.

The potential for a fabric to protect its wearer from ultraviolet radiation is described as its Solar Protection Factor (SPF) or, more commonly, its Ultraviolet Protection Factor (UPF). UPF relates to the time taken before human skin begins to redden after exposure to ultraviolet light – and is usually measured on a scale of 0-50.

Until recently there was a widespread perception that clothing afforded complete protection against such radiation, however, there is an increasing understanding that this may not necessarily be the case. Some fabric constructions perform much better than others, as do some fibre types.

# WHY UV PROTECTION IS IMPORTANT

Exposure to ultraviolet radiation is associated with some beneficial effects on human health (involving vitamin D synthesis and bone development). However, there are significant risks associated with overexposure to UV radiation. The most well known effects are sunburn, an increased risk of skin cancer, and premature ageing of the skin. Children and individuals with fair skin are at particularly high risk.

UV radiation is a component of the solar radiation that comes from the sun and reaches earth in several different forms. The components of this solar radiation are given different names depending on their wavelength. For example, visible radiation comprises radiation with wavelengths that are detectable by the human eye (as light and colour). Other forms are infra-red radiation and ultraviolet radiation.

Ultraviolet radiation (UV) can be further broken down into UV-A (400-315 nm), UV-B (315-280 nm) and UV-C (100-280 nm). Shorter wavelength radiation (such as UV-C) is generally considered more harmful than longer wavelength radiation, but most is absorbed by the earth's atmosphere, so much of the focus to date has been on the effects of UV-A and –B.

The intensity and distribution of UV radiation differs daily, seasonally and geographically. This means that there is a higher proportion of harmful radiation at midday compared to in the morning, in summer compared to winter, and at the equator compared to the poles (Reinert, et al, 1997). The amount of harmful radiation also increases with altitude (approximately 20% per 1000m), and where ever sunlight is strongly reflected (e.g. on ice, snow, beaches and water) (Reinert, et al, 1997).

A common effect of UV exposure is 'erythema' (sunburn). This occurs when skin cells are damaged by the absorption of energy from UV rays. As a response to this damage, the body sends extra blood to the damaged skin in an attempt to repair the damage, thus accounting for the redness that is associated with sunburn.

Another effect of UV exposure, particularly over an extended period of time, is photoaging. Globally, excessive solar UV radiation exposure caused approximately 60 000 premature deaths in the year 2000. The greatest burden results from UV radiation-induced cortical cataracts, cutaneous malignant melanoma and sunburn.

# PREVIOUS OPTIONS

(LIMITATIONS OF OTHER FIBRES)

There is an increasing awareness that clothing does not provide complete protection from UV radiation, and that some fabrics and constructions perform much better than others, as do some fibre types – like merino.

A fabric's ability to protect its wearer from ultraviolet radiation is described as its Solar Protection Factor (SPF) or, its Ultraviolet Protection Factor (UPF). UPF is a measure that relates to the time taken before human skin begins to redden after exposure to ultraviolet light, and is measured on a scale of 0-50.

UPF is similar to the SPF rating you see commonly on sunblock lotions. To assist consumers and manufacturers in understanding how the UPF factor might vary between fabrics, several international standards have been developed to enable quantification of the level of protection conferred (eg. AS/NZS 4399:1996, EN 13758-1, UV Standard 801).

Responding to this, many manufacturers now include reference to UPF factors in their technical and promotional literature, particularly where apparel is used in applications or markets where exposure to sunlight may be high (eg. swimwear, summer outerwear etc.).

Many factors influence the level of ultraviolet protection a garment provides. When radiation strikes a textile surface some components are reflected, some are absorbed, and some pass through it. The greater the amount of radiation able to pass through the textile, the lower the UPF.

The most important of the factors influencing UPF are summarised below:

- Fibre type (with the UPF being dictated by such things as chemical composition, ecru colour, fibre cross sectional shape, presence of delustrants, etc). Merino fibre typically has a much higher UPF than synthetic fibres such as polyester.
- Fabric density (with denser knit/weave structures conferring a higher UPF).
- Degree of stretch (with the UPF being lowered in a stretched state).
- Fabric colour (with the UPF factor conferred being dependent upon the amount of dyestuff present and the chemistry of the dye itself – noting that darker colours usually, but by no means always, result in a higher level of protection being conferred).
- Whether the fabric is wet or dry (with the UPF decreasing markedly when wet).
- Finishing agents. Presence of UV absorbing finishes and/or optical brightening agents (with a range of proprietary finishes able to be applied to fabrics in order to increase the UPF).
- Garment construction and design.(with heavier weighted or less porous constructions and designs offering increased protection)

# MERINO WOOL SOLUTION

Merino fibre affords excellent UV protection. Research by Hilfiker (1996), Reinert (1997) and Haerri (2000) has shown that wool absorbs radiation throughout the entire UV spectrum, whereas untreated cotton, nylon, acrylic, and silk are poor absorbers of UV. Polyester absorbs UV predominantly at low wavelengths – but with little benefit as these are the same wavelengths that the earth's atmosphere is also efficient at screening out.

In a study by Gamblicher et al (2001) more than half of 236 fabrics surveyed fell below the European standard for ultraviolet protection of UPF >30. However, 100% of the Merino fabrics passed the test, with even the worst performing fabric still having a UPF greater than 40 (Table 1). In contrast, all of the linen samples, and 89% of the viscose samples tested fell below the standard of UPF 30. Other fabrics tested (nylon, cotton and viscose) fared equally badly. For example 79% of the cotton fabrics had a UPF ≤20.

Table 1. UPF Factor for 236 summer fabrics. % of fabrics by UPF (Adapted from Gambichler et al 2001)

| UPF factor | 0+ | 5+ | 10+ | 15+ | 20+ | 25+ | 30+ | 35+ | 40+ | 45+ | 50+ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wool | - | - | - | - | - | - | - | - | 9.1 | 18.2 | 72.7 |
| Cotton | 7.1 | 21.4 | 14.3 | 14.3 | 21.4 | - | - | - | 7.1 | 0.0 | 14.3 |
| Linen | 0.0 | 30.6 | 27.8 | 22.2 | 16.7 | 2.8 | - | - | 0.0 | 0.0 | 0.0 |
| Viscose | 40.6 | 10.9 | 9.4 | 18.8 | 6.3 | 3.1 | 3.1 | 3.1 | 1.6 | 1.6 | 1.6 |
| Nylon | 37.5 | 6.3 | 18.8 | - | - | - | - | - | - | - | 37.5 |
| Polyester | 2.3 | 0.0 | 0.0 | 4.7 | - | 2.3 | 2.3 | - | 4.7 | 7.0 | 76.7 |
| Blends | - | - | 3.8 | 5.8 | 3.8 | 7.7 | 5.8 | 7.7 | 5.8 | 13.5 | 46.2 |

UV protection can be increased by using chemical finishes on textiles. UV absorbing finishes and/or optical brightening agents can be applied to fabrics to increase their UPF. Merino fibre can also be treated to impart a higher UPF than that which occurs naturally. However as mentioned above, wool has a chemical free, naturally high UPF as a function of its complex internal structure and chemistry.

# SUMMARY

UV radiation reaching earth from the sun can have deleterious effects on human health when overexposure occurs. Merino fibre is a very efficient absorber of potentially harmful UV-A and UV-B radiation.

Fabric construction is also a key determinant of the extent to which textiles will protect a wearer from UV radiation. Lighter weight merino garments, designed for use in the summer have been consistently shown to offer a higher degree of UV protection than fabrics constructed of competing materials for equivalent uses.

UV protection can be increased by using chemical finishes on textiles, including merino, however merino fibre has a naturally high UPF, without the addition of chemicals.

# REFERENCES

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