Human beings need the sun to survive, but because the human skin is sensitive to ultraviolet (UV) radiation, we are continually looking for ways to protect ourselves from the harmful effects of these rays. The quest for sun protection has taken precedence in manufacturing, and lotions, clothing and detergents all utilize UV analysis to measure the protective qualities of these products. Spectrophotometers can quantify the amount of sun protection these products provide, ensuring that skin stays protected and compliance with regulatory standards is attained.

Measuring sunlight

Human skin is sensitive to UV radiation wavelengths up to 400nm. As the sun's radiation reaches the Earth's surface it is generally comprised of wavelengths in the upper 200 nm range. Therefore, UV analysis is mostly concerned with the 200-400nm range of measurement when determining the effects of solar radiation on human skin. CIE Erythemal Effectiveness tables[1] have been developed through many subject samples by averaging the sensitivity of skin to UV radiation. These measurements use the reflective spectral effectiveness (Eh) at 5nm intervals within this 200-400nm range. Spectrophotometric UV analysis uses light absorption measurements to quantify the reflective value when determining the effects of solar radiation. This same UV analysis method is then applied to the development of UV blocking products and determining their effectiveness.

Choices UV protection

UV radiation is classified by the ultraviolet light wavelength measurement and categorized as either UV-A, UV-B or UV-C radiation. UV-A corresponds with the longest wavelength in the UV spectrum and makes up about 95% of the UV radiation that reaches the Earth's surface. Even though UV-A is less damaging than UV-B, it is much more predominant and is still responsible for eye damage, premature aging of the skin, and skin cancers.

Most sunscreens do not adequately block UV-A rays and can leave the skin susceptible to damage. Many believe that wearing protective clothing provides the best defense against UV-A radiation. As manufacturers look to provide better choices in UV-blocking fabrics and detergents, many rely of UV analysis to determine the effectiveness of these products and additives.

Regulations and monitoring effectiveness

Sun-protective clothing is often rated using the Ultraviolet protection factor (UPF) code[2]. This coding system is regulated by various governing agencies such as the American Society for Test Materials (ASTM)[3] and the American Association of Textile Chemists and Colorists (AATCC)[4], which develop guidelines for UV analysis and transmission testing to ensure product effectiveness. The U.S. has some of the most stringent regulations regarding the effectiveness of UV-blocking materials and detergent additives, so top manufacturers of these products must rely on quality instrumentation to meet these specifications.

Multiple measurements for transmission testing are required to meet regulatory standards for clothing that will continue to be effective after multiple washings and exposure to chlorinated water and sunlight. These tests require continual monitoring to test for any product degradation or loss of effectiveness. Spectrophotometers offer rapid and repeatable quantification and UV analysis that can be monitored throughout the production process. The information that is provided by these analytical tools is then used to inform decisions and changes to manufacturing and formulations, saving both time and materials.

Investing in quality UV analysis instrumentation adds value to the production of sun protective fabrics and detergents.

Full article with photos available here:

https://www.hunterlab.com/blog/color-chemical-industry/defensive-measures-uv-analysis-of-sun-protection-in-fabrics-and-detergents/