Color Measurement of Synthetic Fibre

Color Perception and Analysis

Overview

Synthetic fibre is an artificial man-made fibre manufactured from synthesized polymers. The compounds of synthetic fibre come from raw petroleum based chemicals or petrochemicals. Most synthetic fibres are made by forcing liquid chemicals through tiny holes called spinnerets into the air before it cools down in the water and forms threads. This process is known as extrusion.

About half of all fibre usage involves synthetic fibres. They are used in every field of fibre and textile technology. Synthetic fibres are potentially valuable commercial products, particularly nylon, polyester, acrylic and polyolefin. These 4 classes of synthetic fiber accounted for approximately 98% of synthetic fiber production, with polyester alone accounted for 60%.

The advantages of synthetic fibres when compared to natural fibres are that they pick up dyes more readily and are more durable. In addition, adding different types of chemicals enable synthetic fibres to be wrinkle free, flame-resistant, stain-resistant, water proof and stretchable. They have a wide range of use that include, but not limited to clothing, sportswear, swimwear, lingerie and even hair extensions and wigs.

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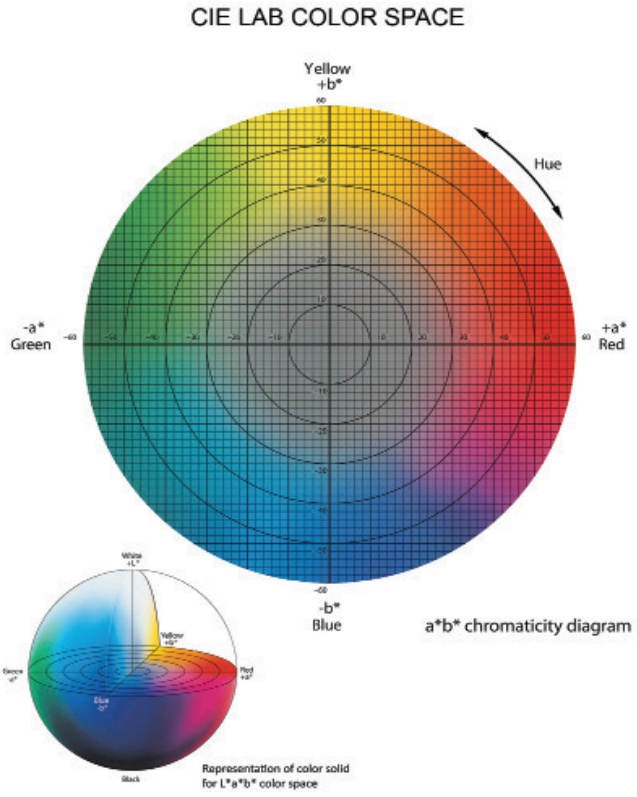
Consumers choose synthetic fibres partly due to its ability to pick up dyes easily; making color an important aspect of production.

Synthetic fibres are produced in either colored or “ecru” (natural white) form, and color dyes are needed for the “ecru” form to be colored. The 2 types of dyes used are mainly colored dyes and optical brightening agent (OBA). OBA is used to produce fibre threads that are whiter than natural white.

To effectively quantify color of synthetic fibres, it is recommended to use the CIE L*a* b* color space as this color space is widely recognized. Konica Minolta provides three spectrophotometers that are best suited to measure synthetic fibres, namely the CM-3600A, CM-3700A and the CM-5. These instruments provide the CIE L*a*b or ΔL*a*b* data, which help manufacturers to the control color consistency and quality of their products.

The CIE color space is a highly influential system for measuring color and distinguishing between colors. L* represents the difference between light (where L*=100) and dark (where L*=0), a* represents the difference between green (-a*) and red (+a*), and b* represents the difference between yellow (+b*) and blue (-b*).



As for whiteness measurement, the whiteness index like ASTM E313-73 or ASTM E313-96 is recommended. If the product is formulated with an optical brightening agent, an instrument with the ability to emit and pick up UV properties is recommended as UV is absorbed and re-emitted by OBA to make synthetic fibres appear whiter. The CM-3600A and CM-2600d are suitable instruments for this case.

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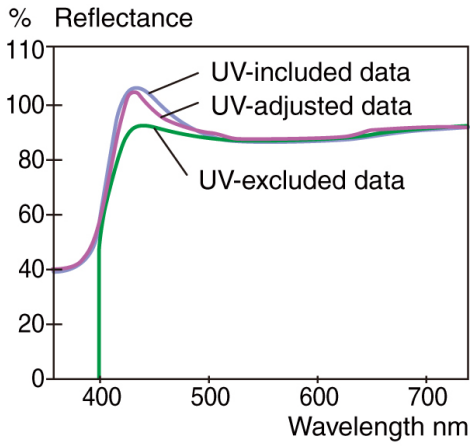

UV adjusted readings from the CM-3600A

Metamerism is also another type of color quantification which manufacturers can look into. As dyes may be supplied from different suppliers, metamerism might occur when the synthetic fibres are presented under different light sources. With the help of the metamerism index (MI), we are then able to quantify the color discrepancy of the sample product when viewing under different light sources.

Apart from using instruments to quantify the color of synthetic fibre, visual evaluation together with the use of a light booth is also recommended. Visual evaluation is the determining factor of how we humans see the actual product.

Color Control and Communication

As synthetic fibres are commonly used in creating fabrics in the textile industry, guidelines must be established so that the fabrics color can effectively be controlled and communicated to ensure color consistency. One such guideline is the 'ACT (Association for Contract Textile) Color Measurement & Communication Voluntary Guidelines & Glossary'.

In this guideline the recommendation of primary and secondary light sources for color communication are:

- CIE Illuminant Daylight 6500K (D65)
- CIE Illuminant Cool White Flourescent (F2)
- CIE Illuminant Incandescent (A)

Other light sources like TL84 or Illuminant C are used for checking metamerism.

The recommended specification of spectrophotometers for color communication are as follows:

- Color Space: CIE L* a* b*
- Illuminant: D65, A or F
- Standard Oberserver: 10°
- Specular Component: Excluded
- Geometry Type: Sphere Type
- UV (Ultra Violet): Included

Recommendations for More Accurate Measurements

Synthetic fibre thread:

- Ensure the thread is in the form of a thread roll.
- Use a large measuring area (e.g. Ø30mm measuring area) for better repeatability.
- Ensure the thread roll or yarn is large enough to cover the measuring port of the instrument.
- Ensure the thread roll or yarn has no gaps (holes).
- Measure multiple times over several spots and take the average data (at least 3 - 5 points to check color consistency).

Synthetic hair:

- Tie a bunch of synthetic hair together using a rubber band or tape, to create volume and thickness.
- Use a large measuring area (e.g. Ø30mm measuring area) for better repeatability.
- Ensure the bunch of hair is large enough to cover the measuring port of the instrument.
- Comb the hair in one singular motion.
- Ensuring there are no gaps (holes) in between the hair strains.
- Measure multiple measurements over several spots and take the average data.
- Apply consistent force by using a white tile or weight for each spot measurement.

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Synthetic Fabric:

- Sample thickness (two to four folded layers to achieve an opaque presentation)
- Use a large measuring area (e.g. Ø30mm measuring area) for better repeatability.
- Measure multiple times over several spots and take the average data (at least 3 - 5 points to check color consistency).

Konica Minolta Sensing offers a wide range of instruments for measuring and quantifying color of synthetic fibre. For more information on color measuring instruments, please visit https://sensing.konicaminolta.asia/color-measurement/.

Alternatively, you can email us at ssg@gcp.konicaminolta.com or call us at +65 6895 8685 to find out more about our product range or solutions.