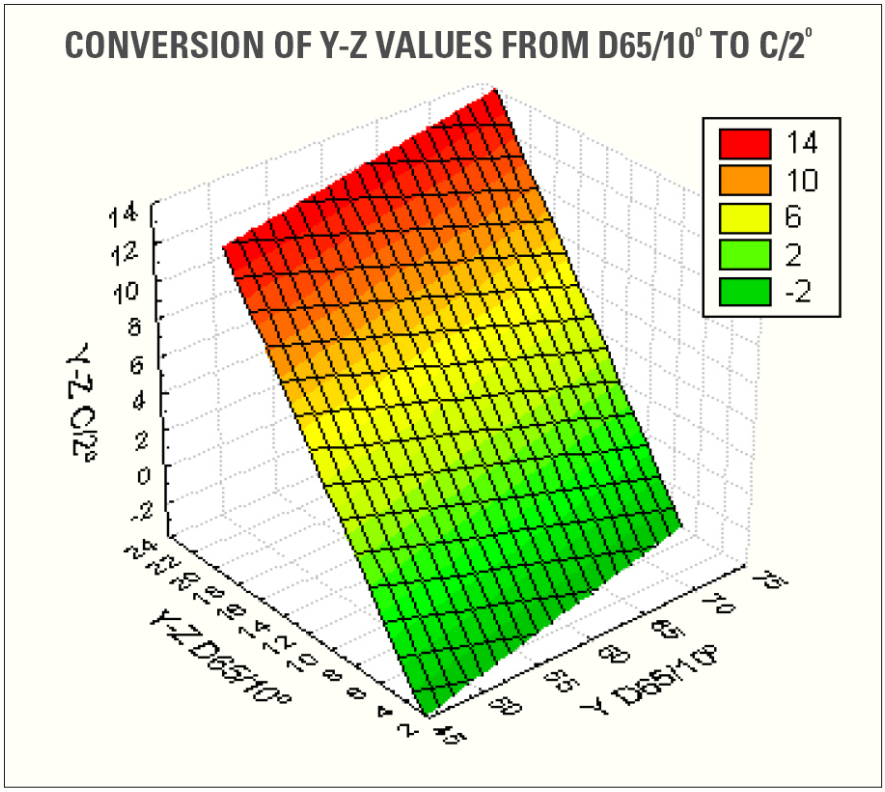
COLOUR MEASUREMENT: D65/10° AND C/2° REFERENCE SYSTEMS

INTRODUCTION

For 25 years, wool colour measurement was tied to a calibration system based on reference wool provided by WRONZ. Measurements were carried out in what is known as the C/2° colour space.

In 1986 IWTO produced a draft test method that incorporated both the New Zealand test method (NZS 8707) and the Australian test method (AS 3546) into one document. In essence this document contained 2 separate test procedures.

After a series of investigations in the late 1990's, reviewed in considerable detail by an IWTO colour working group, a new calibration system was introduced into the method, and IWTO-56 was published as a full test method. This Standard still retained most of the original 2 procedures, but with the addition of the option to measure in a new colour space (D65/10°), which was established using traceable reference tile calibrations. It was considered that this new colour system was of more use to downstream users, and would additionally be more stable.



New Zealand Wools – Waring Blendor Bareme

IWTO made the decision that C/2° would be phased out, but the complexity of options and some ambiguities within IWTO-56 resulted in the potential for systematic differences between laboratories. Following extensive investigation in New Zealand, a new IWTO colour working group was set up in 2002 to examine these issues, and in Dec 2002 it recommended a major revision to IWTO-56.

Alongside the changes to IWTO-56, it was agreed that all laboratories must now certify in D65/10° space, with the option also to continue calculating values in C/2°. This agreement was subject to the C/2° values only being calculated from D65/10° measurements using prescribed 'baremes', and with the proviso that the certification of C/2° values would cease by July 2004. However, due to user demand, this sunset period was subsequently revoked for NZ wools, which continue to be certified in C/2° space (derived from D65/10° measurements).

CONVERTING BETWEEN SYSTEMS

Fortuitously there are linear relationships between the results from the two measurement systems. However, there are, unfortunately, two historic baselines.

In New Zealand, the colour measurement system in C/2° had always been based on preparation using the Waring blendor method. This produced slightly brighter results than the core scour and Shirley Analyser preparation used in Australia and elsewhere (and which is now universally used in the new system).

D65/10° - D65 standard illuminant, 10 degrees viewing angle

C/2° - C standard illuminant, 2 degrees viewing angle

D65 is intended to simulate daylight. The C illuminant was an earlier attempt to produce this from incandescent illumination with filtering.

Users of Australian wool had become used to C/2° values calculated using what is now known as the 'measurement bareme', whereas users of New Zealand wool have always been familiar with C/2° values produced by the Waring blendor preparation system. However, with the new revision, all IWTO certification laboratories should now be producing compatible results in D65/10°. The use of baremes was considered a temporary measure until such time as users gain familiarity with the D65/10° values. The baremes are detailed in IWTO-56:

For measurement only (mainly Australian wools):

Xm = -3.6935 + 0.9834 Xt

Ym = -1.9252 + 0.9288 Yt

Zm = -1.4508 + 1.0405 Zt

(Y-Z)m = Ym - Zm

Where Xm, Ym, and Zm are the C/2° tristimulus values equivalent to those that would have been measured by an instrument calibrated to reference wool; and Xt, Yt and Zt are the D65/10° values measured by an instrument calibrated with certified tiles and corrected for the cell glass effect.

For conversion to Waring blendor values (New Zealand wools):

Xw = -3.3059 + 1.0222 Xt

Yw = -0.8881 + 0.9562 Yt

Zw = -2.6089 + 1.1415 Zt

(Y-Z)w = Yw - Zw

Where Xw, Yw, and Zw are the C/2° tristimulus values equivalent to those that would have been measured by an instrument calibrated to reference wool, on samples prepared using the Waring blendor procedure.

Because of the different slope coefficients for Y and Z, it is not possible to directly convert Y-Z values - it is necessary to convert the individual tristimulus values first and then calculate the difference. As can be seen in the plot above, the Y-Z conversion is affected by the brightness (Y) value.

Combinations are now carried out in D65/10° space and the combined results then converted to C/2° if required. Small errors may occur if combinations are attempted using the component C/2° values.

FOR ENQUIRIES

Email us at NZ.wool@sgs.com
Or contact us at:
48 Kemp Street, Kilbirnie
PO Box 15062
Wellington, New Zealand
Tel: + 64 4 387 8565
Fax: + 64 4 387 8651
www.sgs.com/agriculture