Scientific Software

Instrumental assessment of light fastness according to ISO 105 – B02

Research Report No 4

Research report no. 4: Instrumental light fastness assessment

In Europe, colour fastness to light of textiles is normally assessed by following ISO 105-B02. In the norm, five different methods are specified, with method 2 being the preferred choice when many samples are to be checked. In practice, colour evaluations are mainly made visually in a light booth. An important reason why instrumental methods, e.g. using a spectrophotometer, are not popular is that current colour difference formulas fail to correlate well with the visual assessment of blues, particularly in the critical range of grey scale ratings between 3 and 4-5 [1]. Therefore, with a view of developing an improved colour difference formula suited for light fastness assessments, panels prepared from blue wool standards with varying ratings were evaluated by 22 professional colour assessors. The proprietary new formula was incorporated in the SmartScan system sold by Mathis AG [2]. SmartScan ratings showed good agreement with the average visual assessment, making the accurate and precise instrumental measurement of ISO light fastness a reality.

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Experimental

Using blue wool standards number one to seven, a total of 55 panels were prepared, each sample measuring 4.5 cm in length and width and mounted on a non-fluorescence white card. The samples were then treated in an Atlas Xenotest device according to ISO 105-B02 standard conditions so that the grey scale rating varied between 2-3 and 5 in half-note steps. For each half-note target grade (2-3, 3, etc.), at least two samples were prepared. For blue wool standard number seven, however, only samples with target grades 4, 4-5 and 5 were prepared due to the long exposure time.

The samples were assessed visually by 22 experienced colour assessors from Hugo Boss and four testing labs in Germany and Italy. Additionally, the rating of each sample was measured with a Datacolor SF600X spectrophotometer, using the ISO CIELAB formula, and with SmartScan, using the new blue wool formula.

Results

The average visual rating of all samples was 3.72. While the spectrophotometric measurement yielded an average value of only 2.98 (i.e. it was much too 'strict'), the SmartScan average value came close with an average value of 3.58. The average absolute difference between the SmartScan rating and the visual assessment was 0.21 and much lower than the spectrophotometric difference of 0.74. The maximum difference between the new formula and the visual assessment was 0.59, i.e. half a grade while it was one and a half grades (1.65) for the spectrophotometer.

	Visual	Spectro (ISO)	SmartScan
Average rating	3.72	2.98	3.58
Average difference to visual	N/A	0.74	0.21
Maximum difference to visual	N/A	1.65	0.59
Average difference between operators	0.58	N/A	N/A
Maximum difference between operators	0.92	N/A	N/A

When comparing the visual assessments, the difference between operators (inter-operator variability) was 0.58, i.e. the highest (or lowest) visual rating by any assessor was, averaged over all samples, 0.58 units higher (or lower) than the average of all assessors. This is almost three times more than the average SmartScan error of 0.21. The maximum inter-operator variability was 0.92, nearly twice as much as the maximum SmartScan error of 0.59. This means that while the highest SmartScan error was half a grade from the

average (e.g. 3-4 instead of 4), the highest error of the visual assessment was one grade (e.g. 3 instead of 4).

Conclusions

The study confirmed that the ISO CIELAB formula is not suitable for assessing light fastness according to ISO 105 – B02. The new SmartScan formula, on the other hand, agreed well with the average visual assessment. The variability of the visual assessment, introduced by differences from one operator to another, was around two to three times higher than the SmartScan error, demonstrating the benefits of instrumental assessment. SmartScan is the only system on the market using the new colour difference formula for blue wool samples.

References

[1] Witt K, Color Research and Application, 20, 399, 1995.

[2] http://www.mathisag.com