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# EBC Method 4.7.2 Colour of Malt: Visual Method – Yellow Spot Colour Discs

Submitted on behalf of the Analysis Committee of the European Brewery Convention

Descriptors: Analytica-EBC, colour of malt, visual method

## 1 Introduction

In January 2005 the Crisp Malting Group Central Laboratories compared a new 3-field colour comparator and discs, on loan from The Tintometer Ltd, with their current Tintometer equipment prior to its being serviced and recertified by the manufacturer. Investigations showed differences between the two sets of yellow spot colour discs.

## 2 First Results

Contact with The Tintometer Ltd revealed that in December 1999, Tintometer's colour laboratory became certified to ISO/IEC 17025:2000 as a traceable colour calibration facility. In October 2002 (10/02) the approved master set of EBC yellow spot discs was realigned to the reference CIE (Illuminant B) chromaticity co-ordinates published in 1997 in ANALYTICA-EBC. Changes to the discs were small and notification to the brewing and malting industries was considered unnecessary. The net effect, however, was to create two slightly differing standards within the yellow spot coding of the discs, *viz*: pre 10/02 and post 10/02.

A co-operative assessment involving Crisp Malting Group, Green-core Malt and The Tintometer Ltd examined a range of beers and laboratory worts. Colours were determined by five analysts using new 2-field and 3-field comparators with new pre- and post 10/02 disc sets. Spectrophotometric readings were also obtained.

Paired t-tests were carried out on the 2-field and 3-field comparator data. In both cases, significant differences at the 95 % confidence level were detected between pre 10/02 and post 10/02 disc sets. No significant difference was found between 2-field and 3-field comparators. Data from both sets of discs were found to be statistically different to the spectrophotometer data, although the post 10/02 discs were a closer match. Analysis of variance showed that there was no significant difference between the analysts involved in the experiment. The relationships between colour from the two sets of discs and spectrophotometric colour were found to diverge as colour increased (see Table 1).

The differences in the disc readings, although apparently small, could have a significant commercial impact in the trading of beer and malt, and particularly for suppliers of speciality malts to brewers. It is possible that the values for colour reported by laboratories using pre 10/02 or post 10/02 yellow spot disc sets could result in product being dispatched within specification by a supplier but being rejected on evaluation by a customer.

A full report is to be submitted for publication.

## 3 Statement from The Tintometer Ltd

The results of this initial assessment show that there are some differences in readings between old and new yellow-spot discs, and that the new discs post-October 2002 are a closer match to the Analytica-EBC reference standard. However, it is questionable whether or not these changes have any significant impact at the commercial interface. This is because the assessment also highlighted the difficulty in obtaining a match to the EBC colour scale with the range of beers and laboratory worts analysed. Many of the samples were sufficiently 'off-hue' (having a colour different to those on the scale) to make 'matching' more a case of estimation.

The application of paired t-tests at 95 % confidence level, as used to develop Table 1, raises certain anomalies with the assessment that at present cannot be fully explained. For example in 63 % of the reported "significant changes", no significant changes to the glass standards have actually taken place. These minor adjustments are only detectable with a spectrophotometer but do not result in visually noticeable change to the disc colours. These anomalies may be due to the difficulty in matching products that are off hue. Furthermore, it is evident that there is significant difference between different analysts measuring the same sample – e.g. there is a range of 0.8 on the 9.5 sample.

The brightness of some samples may be a further contributing factor to inter-company disagreement on EBC results. These factors corroborate the findings of an earlier inter-laboratory study (White, F.H., Journal of The Institute of Brewing, 1995, 101, 431). The assessment also revealed that industry practice in specifying to 0.1 on the EBC colour scale (as shown on the attached table) is capable of resulting in disagreement with consequences for the commercial interface.

The Tintometer Ltd. takes a different perspective on the statistical analysis. It is unlikely that the major variable is the difference in the master standards. Any differences are more likely attributable to variance between analysts or off hue samples. This assessment highlights that there are important issues to address:

- how closely do current industry colours of beers, malts and worts match the EBC scale and should there be changes to the EBC scale to reflect current practice?
- what tolerances should be set on colours to be matched to the EBC scale, both on a spectrophotometer and visually?
- is it possible to discriminate to 0.1 EBC and if not, how should the industry proceed?

- would brightness measurement help the industry? The EBC scale makes no provision for brightness of the sample.

The Tintometer Ltd. suggests that a way forward to resolve some of these questions is to carry out a full inter-laboratory study under the auspices of the EBC Analysis Committee and in cooperation with the industry. The Tintometer Ltd. thanks Crisp Malting Group Ltd. and Greencore Malt for providing the opportunity to raise these important issues.

#### 4 Offer of help from The Tintometer Ltd

Should any customer require information on the historical changes that have taken place with EBC visual discs or wish to identify if the discs are pre or post 10/02, please contact The Tintometer Ltd. A traceable EBC standard (post 10/02) will be made available to laboratories wishing to evaluate their own equipment.

*Received 22. June 2005*

**Table 1** Illustration of potential shift in colour values for glass discs based on 2 field comparator readings

Disc set	Pre 10/02 disc value	Post 10/02 disc equivalent	Disc set	Pre 10/02 disc value	Post 10/02 disc equivalent
a	2.0	1.6	c	10.0	10.3
a	2.5	2.2	c	11.0	11.4
a	3.0	2.7	c	12.0	12.5
a	3.5	3.3	c	13.0	13.5
a	4.0	3.8	c	14.0	14.6
a	4.5	4.3	c	15.0	15.7
a	5.0	4.9	c	16.0	16.8
a	5.5	5.4	c	17.0	17.9
a	6.0	6.0	c	18.0	18.9
b	6.0	6.0	d	19.0	20.0
b	6.5	6.5	d	20.0	21.1
b	7.0	7.0	d	21.0	22.2
b	7.5	7.6	d	22.0	23.3
b	8.0	8.1	d	23.0	24.3
b	8.5	8.7	d	24.0	25.4
b	9.0	9.2	d	25.0	26.5
b	9.5	9.8	d	26.0	27.6
b	10.0	10.3	d	27.0	28.7

e.g. a beer or wort read on the old discs (pre 10/02) as 9.5, would read 0.3 units higher on the new discs (post 10/02) i.e. 9.8

Note: where the reading is multiplied by a dilution factor the impact of the difference increases