

To err is human – Continuous (online) Measurement of Colour to help promote Quality assurance *

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In progressive industrial circles and the market economy, quality is an often encountered but imprecisely defined buzz word. Its meaning tends to vary in accordance with the wide variety of contexts in which it is used.

Quality – “ The standard of something in terms of its ability to meet established, predetermined requirements“ (DIN 55350 Standards, section 11 refers).

Quality assurance is to a certain extent instrumental in helping to achieve these “standards“. Take for instance the many and various options in respect of quality control. Once the talk turns to quality, the words extra expense – be it the cost of personnel, material or investment – usually follow in the same breath. A clear distinction should be made, however, between the two aspects: Quality control is without a shadow of a doubt personnel-intensive. But, if the information it reveals is used to good effect, production and control costs can be cut, and quality improved.

The intention of this article is to outline in some detail the possibilities offered by continuous (online) measurement of colour within the scope of quality assurance.

In spite of the all too familiar problems associated with checking colour visually (lapses in concentration, fatigue, etc.) the naked eye was, until now, still the most effective means of assessing colour at the inspection table. Stationary colorimeters were used in support, but this way of doing things had its drawbacks.

In the case of stationary measurement, one has to take into account that the high personnel costs are also accompanied by the not inconsiderable ones occasioned by material wastage. This is brought about by the need to cut samples at regular intervals from the online piece and then compare them one against the other. More to the point however, processing

requirements render the status of spot-checks virtually inviolable.

In terms of personnel involvement and material wastage (ie.extra sewings and shorter pieces), the cost of splitting a batch into rolls of matching colour in order to meet a customer’s specifications is quite substantial.

A practical example:

At a dyehouse producing an average of 40000m of cloth per day, material wastage occasioned by visual, colorimeter-assisted colour checks amounted to some 65000 – 95000 Euros per annum.

Online measurement of colour with Mahlo’s new CIS-10A Color Inspection System (Fig.1) resolves the abovementioned problems.



Fig. 1: Color Inspection System CIS-10A

It dispenses completely with the job of cutting out samples at the inspection table, and by doing so, reduces material wastage and personnel involvement to a minimum.

Furthermore, cloth can be colour-graded at the touch of a button (referred to in detail later in the text), thereby avoiding extra sewings and short pieces..

A further example:

By using a CIS-10A Color Inspection System, the effective line-speed at the perch can be increased by an average of 20% (fewer stop-pages, etc.), whilst the potential saving of 1 or 2 persons in the “sorting and filing“ section can cut personnel costs by some 50000 – 60000 Euros per annum.

A well-known textile finisher found that, by using a CIS-10A System at the perching stage, it had paid for itself in less than 2 months.

The comparison between checking colour visually and online colour measurement really leaves one with no alternative but to monitor colour with an online system from Mahlo!

Several processing stages are likely candidates for a CIS-10A:

1. Incoming goods checkpoint:

At this stage, one has to discriminate between 2 sorts of cloth.

a) grey cloth: checking the colour of grey or white goods helps prevent inconsistencies at a later processing stage.

b) dyed cloth: incoming, previously dyed material can be checked for adherence to agreed tolerances, and to see that the colour matches with that of previous deliveries.

2. Online colour measurement at an intermediate checkpoint:

A colour check at this stage is of particular interest, because it can reveal quickly, consistently and in good time any colour defects or variations. This helps avoid further costly processing at the reworking or finishing stages.

To illustrate the point:

If a dyed batch of cloth is sent for printing with undetected listing or ending, it will not be possible to correct the dyed background once the cloth has been printed. If faultily finished fabric is sent for further processing, this, too, will be very difficult to "repair".

3. Online colour measurement at the final inspection point:

With the help of online measurement at the perch or final inspection table, the agreed tolerances can be monitored and documented in the form of a printout. This is issued at the touch of a button, and serves as proof of finished quality. It also includes a "colour-grading" diagram, which is a most helpful reference for the finished cloth sorters (dispenses with the tedious process of a visual appraisal).

4. Process optimization:

An online colour monitor can also be used to optimize various dyeing processes. By virtue of a great number of measurements, a CIS-10A system produces a sharp, graphical profile (trace) indicating the degree of colour evenness. If it is found that variable machine loadings (eg. jigger, jet dyer) or dyestuff combinations indicate more or less stable results, then the dyer can select and use the best possible operating conditions and dye-stuff combinations.

The system in detail:

The scanner employed by a CIS-10A colour monitor is basically a spectrophotometer with a geometric scan of 0/45°. When in motion, it produces a scanning spot of some 18mm in width and 60mm in length (Fig.2). Measurement repeatability falls short, however, of practicable, sustainable values.

Measurement-related readouts and features:

- Detailed information on any colour listing and ending,
- Sections of the batch that are either inside or outside the tolerance prescribed for the monitored article.
- Sections of the batch of matching colour and shade.

The batch can also be compared with previously processed cloth or samples.

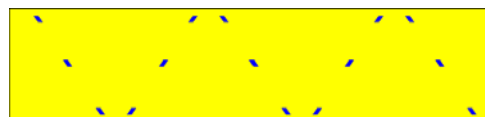


Fig.2 : Diagram illustrating the position of the scanning spot on the online cloth

The size and weight of the scanner have been reduced to optimum proportions, enabling it to run to and fro across the now exceedingly compact traverse assembly at a velocity of no less than 1.2m/sec. As it takes up to 8 measurements per second, the processor is able, therefore, to check for colour evenness in line-speed related grids of 1 to 4 metres.

The assembly's modest dimensions and modular construction enable it to be installed with ease on the widest possible variety of processing lines.

A CIS-10A Color Inspection System is so easy to use that the cost of operator training is cut to a bare minimum. This has been achieved with the help of touch-screen technology (Fig.3), user-friendly software, displays and audio-response in all the usual languages, and alarm messages in text form.



Fig.3: User-interface indicating Delta-E readouts

Via the modem supplied as standard, Mahlo's service department can, once the user has cleared the system, log directly onto it in order to assist in trouble-shooting.

Online measurement of colour with a CIS-10A – practical applications

The best location for online monitoring is governed to a great extent by the given situation and requirements. A few examples will help to illustrate potential checkpoints:

1. On a cloth inspection machine:

This is the most practical place to install an online colour monitor. It poses no problems whatsoever, as this stage of the process is not tied to a dyeing or finishing range, and can be run independently. Optional locations are:

- a) Incoming cloth checkpoint, grey, white or dyed cloth (Fig.4)
- b) An intermediate checkpoint (Fig.5)
- c) Finished cloth checkpoint – documentation for customers (Fig.6)

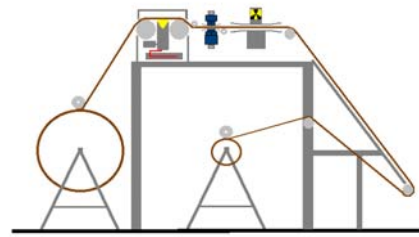


Fig.4: Incoming checkpoint

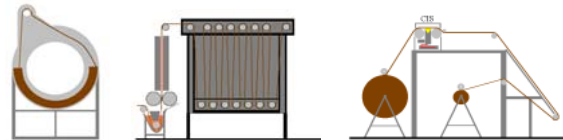


Fig.5: Intermediate checkpoint

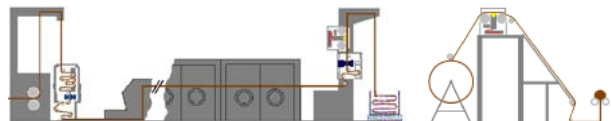


Fig.6: Final checkpoint

The arrangement at the final inspection stage has proved to be particularly effective. Given the information on the evenness of the colour along the batch, the percher can forget all about sampling, and concentrate fully on the search for other faults.

The software-driven "cloth sorting" facility" allows the percher to arrange the individual rolls into grades of colour, thereby dispensing with the process of having to sort them visually. The data printout serves in addition as a quality pass for the garment and allied industries.

Trial installations in the carpet industry have achieved most encouraging results. The up to 6 metre-wide assemblies monitor a wide variety of floor coverings, and obviate the need to cut into 5 metre-wide carpeting for samples. The potential for cost-cutting here is considerable.

2. At the delivery end of a washing range:

If the processing lines include an open-width washing range with cylinder dryer and cooling roller, a CIS-10A Color Inspection System could be used to monitor colour and shade just at the end of a re-washing run (see Fig.7).

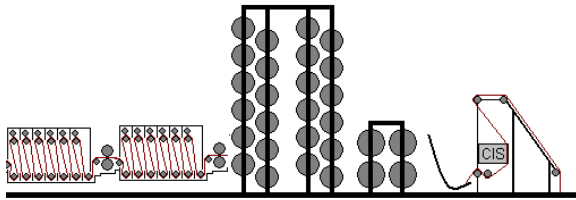


Fig.7: CIS-10A at the end of a washing range

A batch can be assessed here for colour evenness and, if need be, reworked, before it has to be sent for further, cost-intensive processing. As a result, a separate colour checkpoint can be dispensed with.

3. On a stenter:

Provided the online cloth is sufficiently tensioned and at a reasonably constant temperature, a stenter would provide yet a further opportunity to add a colour monitoring system to a processing range.

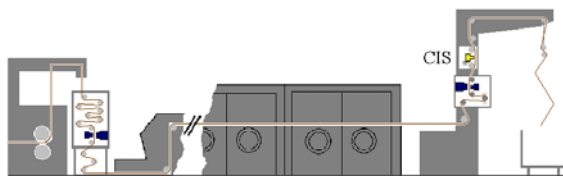


Fig.8: CIS-10A at the delivery end of a stenter

4. On a shrinking machine:

A shrinking machine is usually the very last processing stage before final inspection (Fig.7). By installing a colour monitor at that point, the information it provides can be used by the percher.

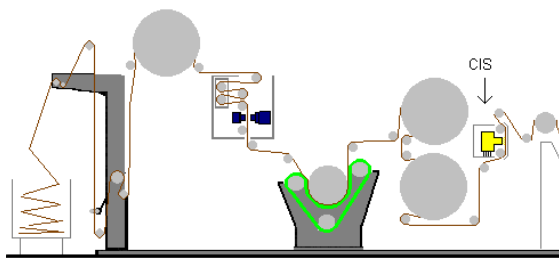


Fig.9: CIS-10A behind a shrinking machine

What, then, does a processor stand to gain by using an online colour monitor?

Online colour measurement produces graphic profiles which highlight any colour unevenness across and along the batch. The very fact that the naked eye has difficulty in discerning subtle variations in shade clearly illustrates one of the major advantages of using an online colour monitor.

Owing to the exceedingly close proximity of each measurement taken by a CIS-10A Colour Inspection System, an exact assessment can be made to see whether the cloth meets the required colour tolerances.

Colour evenness along and across a batch can be documented in the form of, and at the negligible cost of a printout. Consequently, it is quite a simple matter to compare follow-up orders with a previously dyed lot.

The reliability of online colour measurement is held in such high regard that, in many supplier-customer relationships, a printout is accepted as firm proof of the standard of colour evenness.

The following hardcopy printouts illustrate just a few of the advantages of online colour measurement with a CIS-10A system at a typical, intermediate checkpoint.

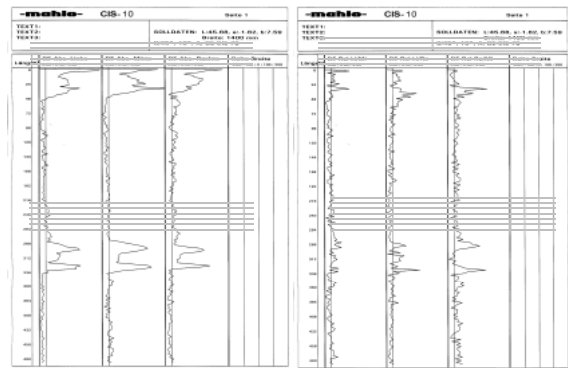


Diagram 1: ending along batch X Diagram 2: listing across batch X

Both diagrams indicate quite clearly that, apart from the start of the batch and over a 40m section at mid-point (290-330m point) where it tends to deviate somewhat, the colour fluctuates slightly, but obviously within the prescribed tolerance.

If the dyer were to make a visual spot check by taking and assessing a sample just at the very section (290-330m) where the colour exceeds tolerance, the verdict would no doubt be "the batch needs to be redyed".

The full printout shows, however, that there really is no necessity to redye the entire batch, since only those sections at the start and between metres 290 and 330 are off-shade.

Upshot: a considerable saving in excess costs!

More to the point, however, a redyed batch would in all probability turn out worse than the original one.

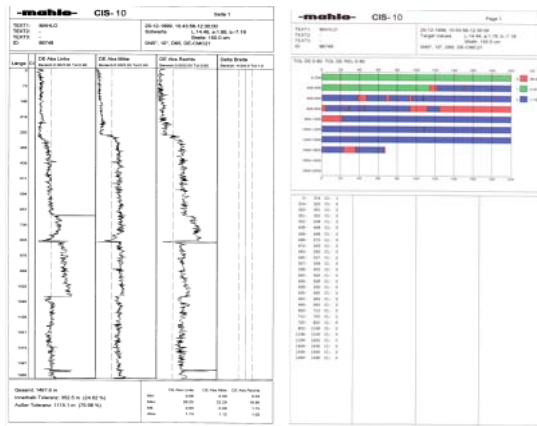


Diagram 3: ending (batch 86748) Diagram 4: cloth grading (batch 86748)

Diagram 3 shows the degree of ending along a dyed batch, diagram 4 the same readouts in the form of a “sorting diagram”.

With a batch dyed like that, it would prove terribly difficult to rework the finished cloth, and equally hard to sort out the batch correctly into grades of shade.

With an online colour monitor, and its various modes of measurement, a batch can be split up into rolls of matching colour and shade. At the touch of a button, the software-assisted cloth-grading facility classifies the batch into pieces of matching colour, and indicates the respective lengths in metres.

Finally, if one objectively compares the previous options of spot-check type, visual assessment of colour with the advantages provided by a CIS-10A Color Inspection System, and considers the savings that can be achieved in processing and personnel costs, the industrialist today really has no logical alternative but to acquire an online colour monitor from Mahlo!

The many years of consultative experience behind the staff of our technical and sales departments enable them to discuss and understand a customer's requirements, and work out a solution tailored to suit.