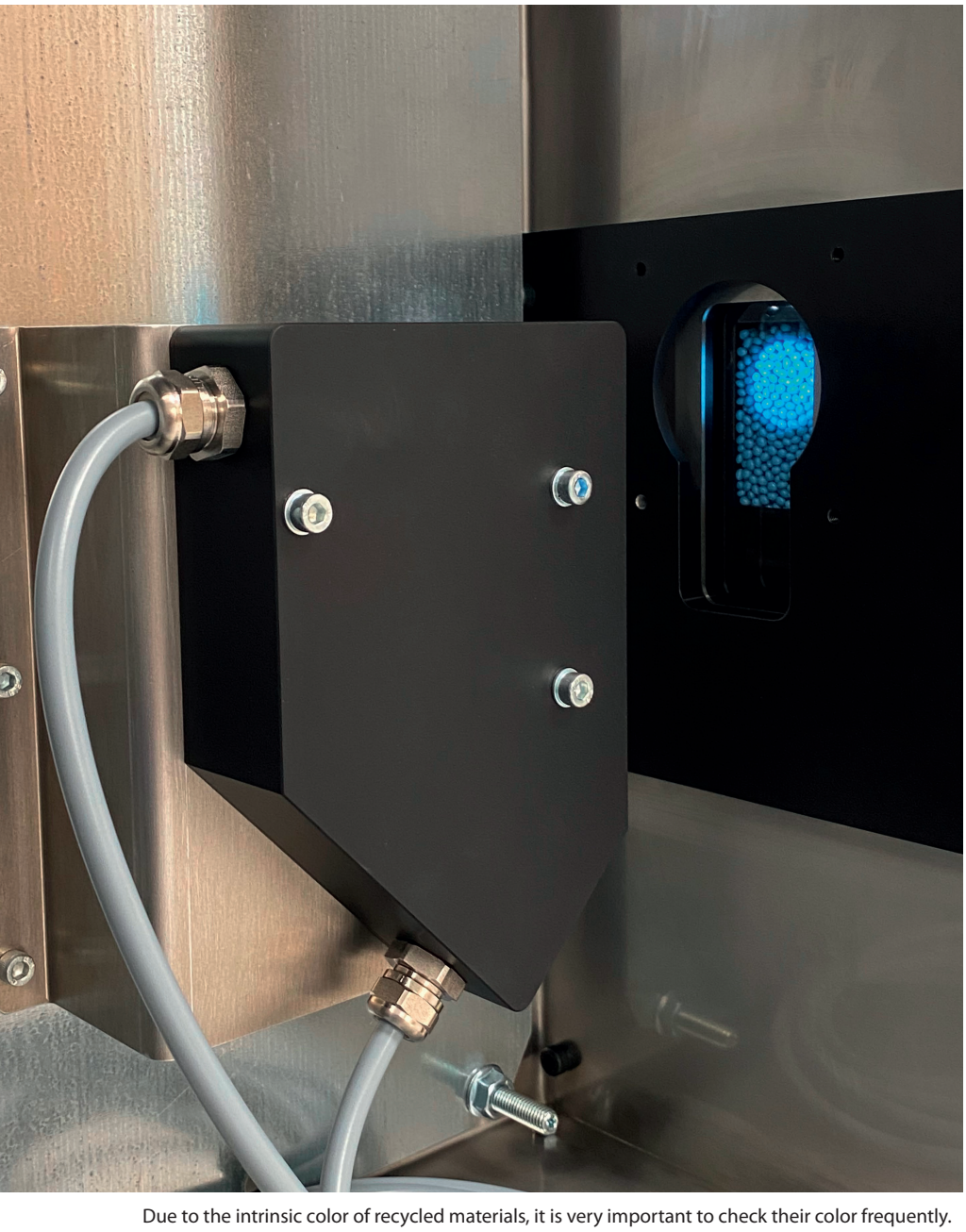
## Ensuring Color Consistency of Recycled Materials

# The Color Loop

The mass of recyclable plastic waste has been growing steadily for years. This is mainly the result of technical advances made in both processing and sorting. At the same time, the recycling targets set by the EU are piling more and more pressure on companies to increase the amount of recycled plastics in their products. This in turn is raising the requirements imposed on the recycled materials themselves. Aside from the nature of the polymer and the previous application, the color of the recycled material is important.



Due to the intrinsic color of recycled materials, it is very important to check their color frequently.

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Keeping the color value of packaging consistent when virgin plastic pellets are being used is a fairly straightforward matter from a process-engineering point of view. Masterbatches, for example, yield really good color uniformity: they are mixed with base pellets in an empirically determined optimum ratio with the aid of sophisticated dosing units. Minimal color deviations occur from packaging to packaging but these cannot be seen by the naked eye. The term dE is used by experts to describe the distance between two color values in L*a*b* color space, and in such cases it is less than 1.

By contrast, the coloring of recycled materials is often more complicated. One problem, for example, is the intrinsic color of the processed plastic waste. So, attempts are made during separation of the recycling stream to keep the color of the recycled plastic consistent by sorting it according to color. However, the color of the product has to be continuously monitored if the tolerance limits for the color value are not to be exceeded. This entails taking samples from the stream of recycled materials at regular intervals and analyzing them with a laboratory colorimetric system.

### *Monitoring the Color Profile of the Recycled Materials*

The Spectro-3–0°/45°-MSM-Lab-ANA-P from Sensor Instruments is a laboratory instrument designed for this very purpose and can be used to monitor and document the color profile of the recycled materials (**Fig. 1**). The instru-

ment displays not only the L*a*b* color value of the sample, but also its deviation (dL*da*db*) from a reference color value. Each sample is additionally documented and labeled with the date, time, and the L*a*b* and dL*da*db* values.

The color measurement system utilizes a 0°-45° geometry in which the recycled material sample is illuminated at 0° and observed at 45°. As the material is disposed behind a glass pane, the distance between the sensor head and the recycled material never varies. The material is illuminated and observed over a surface of roughly 20 mm diameter. This yields a sufficiently high degree of optical averaging, as a result of which the slight differences in the positions of the pellets from measurement to measurement have no significant influence on the readings.

## *Software-Assisted Calibration*

A hopper is used to pack the plastic recycled material as tightly as possible in front of the 15-mm-thick glass pane separating the interior from the exterior. After the reading has been taken, a mechanical slider is actuated and the plastic recycled material is filled back into the sample container. RAL plastic cards are used to calibrate the measuring system (**Fig. 2**). The important thing here is to ensure that the cards are of approximately the same color as the pellet samples. This is achieved by removing the hopper from the measuring system and then inserting the cards one after the other into the dedicated opening provided. The operator is guided through the calibration process by Spectro3 MSM Docal Scope V1.0 software.

## *Color Deviation from the Reference*

The mode of operation will be illustrated below with the example of pastel blue recycled samples. These samples are similar to RAL plastic card RAL 5024-P, which is therefore used for calibrating the laboratory colorimeter. The next step is to fill all of the pellets from the sample container into the space created for receiving the recycled material. With the recycled material now in position, measuring can begin. This is done by calling up the "Teach" menu item in Spectro3 MSM Docal Scope V1.0. Aside from the current L*a*b* color values, the software program displays the color deviations dL*, da* and db* from the reference. Furthermore, the total color deviation in color space dE is displayed numerically. The charts show the location of the current color value and the references used from three different angles (a*b*, a*L* and b*L*).

The Docu software interface displays the last 100 measurements as well as the deviations in L*, a* and b* from the entered reference. The readings can be saved to a file, which can be opened with Microsoft Excel, for example.

As the proportion of recycled materials in packaging increases, so do the imposed quality requirements. Consistency of the color of recycled materials is growing in importance. Reliable color determination is primarily achieved by employing the correct measuring method, selecting a measuring spot in proportion to the particle size, and maintaining a constant distance between the recycled material and the sensors. Quasi-continuous product control is afforded by automatic recording of the readings. A graphical display of the trending color values allows quick intervention, if necessary. ■

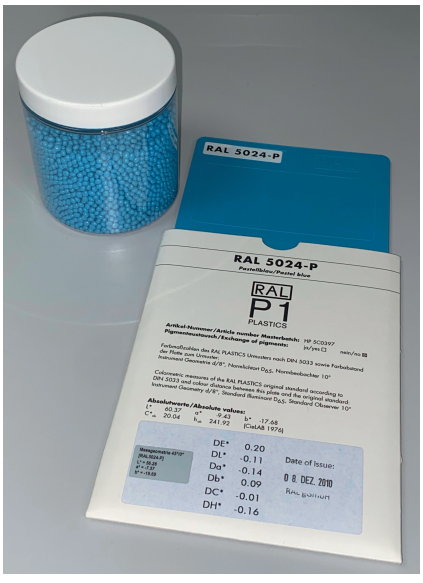


**Fig. 2.** RAL color charts serve as references for the analyses. © Sensor Instruments

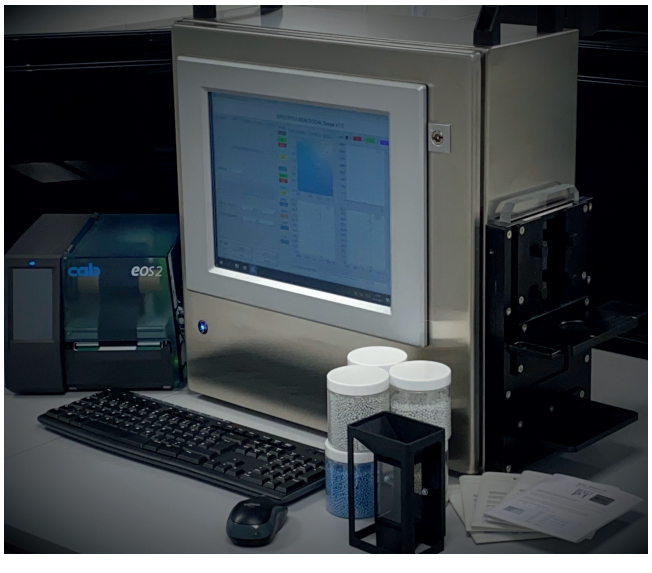


**Fig. 1.** The Spectro 3–0°/45° MSM-Lab-ANA-P laboratory colorimeter can be used to accurately determine color values of recycled materials and any color deviations. © Sensor Instruments

## Info

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