

06-25-2021 (Rev 0)

Topic: Grease Colorimetry

Using a Grease Thief Colorimeter for an Improved Color Response



Figure 1 i-Lab Colorimeter on the left is being replaced by the Grease Thief Colorimeter on the right.

Introduction:

This Technical Bulletin describes the new instrument that provides similar but superior color measuring capabilities to the device and method described in ASTM D7918. The Grease Thief Colorimeter has been developed to determine the color difference of a given grease sample and evaluate the health of the lubricant based on its color deviation from a baseline sample. This instrument combines the use of a color scanner and an arbor press to prepare a grease sample to a controlled thickness for a pathlength-specific optical measurement.

Background:

MRG Labs has historically been completing color measurements using the i-Lab Colorimeter. The i-Lab Colorimeter uses a multiangle measurement geometry as shown in figure 2. Historically MRG labs has used a Differential Spectral Sum to compare the in-service grease spectra to baseline values for the i-Lab Colorimeter. This process involved plotting a graph of wavelength to intensity. The graph would increase when reaching a color wavelength found in the sample. If there is not significant color measurement, there will not be an intense peak as shown in figure 2. Once the graph is created, the area under the graph would be calculated which would be the sample's Differential Spectral Sum value. For example, figure 2 shows an i-Lab color graph of a red-colored grease sample. The graph reaches its peak from about 650-675 nm and has no peaks from 400-575 nm. This indicates the color of the sample is red due to its response in the "red" section of the visible light spectrum. The area under the graph would be calculated for this sample and that value would be assigned to the sample. When used samples would be

compared to baseline samples, the Differential Spectral Sums of each would be compared. The closer the Differential Spectral Sums are to each other, the closer the colors are as well.

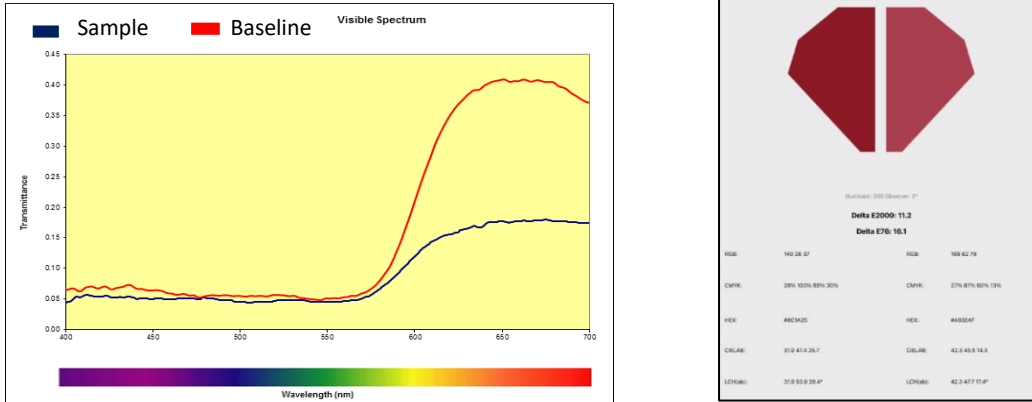


Figure 2 Visible Spectrum graph of a red-colored grease and its baseline using the i-Lab Colorimeter (left) and Color data from a red-colored grease (far right) and its baseline (right) using the Grease Thief Colorimeter.

The Grease Thief Colorimeter uses a 45°/0° measurement geometry as shown in figure 3. It compares color values between the sample and baseline and calculates the difference between them. This difference is denoted as the unitless value, ΔE_{2000} . The smaller the ΔE is between two samples, the closer they are in color. Figure 3 shows a comparison between two red-colored greases on the Grease Thief Colorimeter. The L*, A*, and B* values are displayed for each color, as well as the RGB, CMYK, Hex code, CIELAB, and LCH(ab) values.

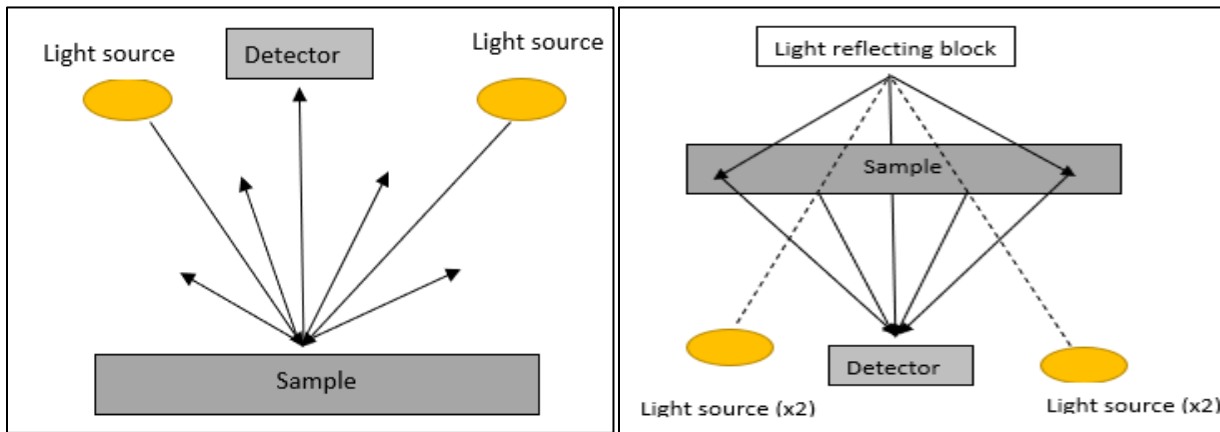


Figure 3 Grease Thief Colorimeter measurement geometry (*right*). AND the i-Lab Colorimeter measurement geometry (*left*)

The Concern:

The i-lab is no longer manufactured or supported. MRG Labs worked to find a repeatable and reliable solution. MRG Laboratories determined the i-lab is not efficient at obtaining color values at controlled thickness. The Grease Thief Colorimeter is able to give accurate color results, while changing the approach as visible in figure 3 and thickness of the grease.



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MRG Laboratories will be switching its color testing from the i-Lab to the Grease Thief Colorimeter. Studies were conducted comparing the effectiveness of the i-Lab and the Grease Thief Colorimeter, and results showed an increase in overall color accuracy with the Grease Thief Colorimeter. A data sheet is attached to this document.

What this Means to You

As of June 28, 2021 MRG Laboratories will no longer perform colorimetry testing using the i-Lab Colorimeter and will switch over to the Grease Thief Colorimeter. The results will be more representative color results and a more comprehensible color comparison. If you have historically based limits on the Differential Spectral Sum from the i-Lab, new limits may need to be created using ΔE_{2000} response from the Grease Thief Colorimeter. Be prepared to look for this data change and understand how your previous color values correlate to the new method.

Recommendations:

It is recommended that once the new colorimeter has been implemented, customers should submit a new baseline sample for all equipment to MRG Laboratories. This will allow the lab to update the baselines and get color values from the new colorimetry method. New acceptable limits should also be determined for the equipment as previous color data using Differential Spectral Sum is not very comparable to the updated ΔE_{2000} method. MRG Laboratories can assist customers as they create new limits, as necessary.

Questions or requests for more information may be directed to:

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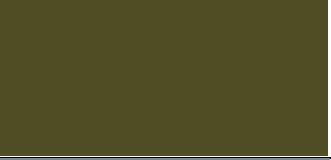
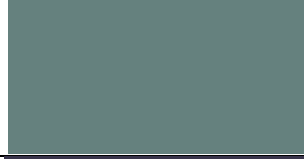

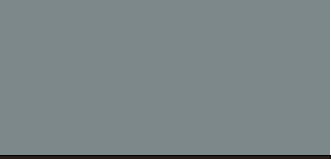

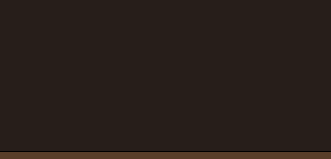
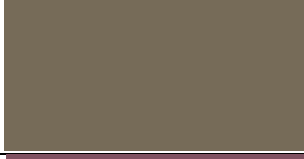

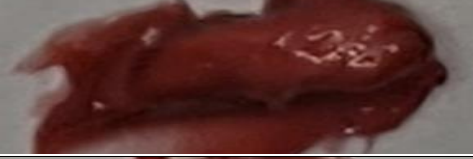
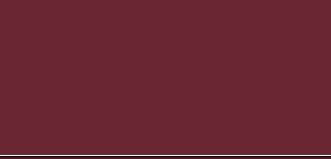
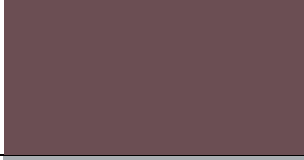


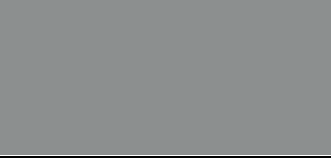
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Keywords

Grease Colorimetry

Grease Thief Colorimeter

Grease Screening

iLab CIE response							Grease Thief Colorimeter CIE response			
L*	A*	B*	ΔE				ΔE	L*	A*	B*
50.48	-7.67	-8.6						10.1	-3.5	-5
40.92	-2.14	9.12	28.05				39.2	32	-2.4	24.2
51.5	11.87	-2.16	14.71				24.1	55.9	-4.4	-2.8
23.59	4.79	12.71	27.40				24.8	12.5	4.3	5.1
46.2	2.65	13.62	23.90				17.5	29.2	11.7	19
41.1	22.32	0.57	10.20				8.7	27.4	32	10.6
36.92	13.39	3.01	12.60				12.6	19.9	29.9	8.7
70.26	-1.59	-3.21	0.00				9.5	59.2	-1	-0.4

21.57	-0.74	1.28	47.00				52.0	14.4	3.9	6.2
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