

VALIDATION ESTIMATION OF DIFFUSE REFLECTION METHOD FOR TEXTILE MATERIALS ANALYSIS

Samolov Aleksandra¹, **Savic Jasmina**², **Rajcic Boris**², **Milovanovic Dubravka**²

¹*Military Technical Institute, Belgrade, Serbia*

²*INN "Vinca" University of Belgrade, Belgrade, Serbia*

aleksandrasamolov@yahoo.com

Diffuse reflection as a feature of dyed coatings is important characteristic regarding camouflage protection analysis. In our laboratory practice, the need for diffuse reflection analysis of textile materials has appeared, recently. Therefore, astm e903-12 [1] method has been modified in order to be applicable for this type of materials.

The measurements of diffuse reflection were conducted, in the military technical institute laboratory for textile, leather and shoes examination in belgrade, serbia, using the uv/vis/nir spectrophotometer uv 3600 from a japanese manufacturer shimadzu with an integrating sphere within wavelength area from 650 nm to 1000 nm. For the purpose of results analyses, uv probe programme package [2] was used.

10 measurements of spectralon (manufactured by labsphere[®]), which is used as a certified reflectance standard, were performed and obtained standard deviation was 0.07 %. Then control sample, a piece of a standard military cloth of serbian army, which has five color shades (light green, beige green, dark green, brown and black) was tested. Standard deviations were in range from 0.09% for black tone on 650 nm wavelength to 2.0% for light green tone on 1000 nm. The combine uncertainty for the method was ± 2.0 %, which coincides with the above mentioned astm standard. In the end, comparative measurements of the same control sample for all five shades were performed in the "vinca" institute for nuclear sciences, department for physical chemistry, university of belgrade on lambda 35 perkin-elmer uv/vis/nir spectrophotometer. Moreover, the z score was calculated as well, and its values ranged from -0.71 to +0.71, which was satisfying regarding interlaboratory measurements rules.

Overall results showed that this method is applicable for diffuse reflection measurements of textile materials.

Key Words: *PROTECTIVE TEXTILES, DIFFUSE REFLECTION, VALIDATION*

1. INTRODUCTION

As stated above the aim of this paper was to show the way specific diffuse reflectance measurements of a textile materials can be validated. The need for this appeared when our Laboratory wanted to be accredited for certain methods. Diffuse reflectance measurements for textile materials was one of them.

2. MEASUREMENTS AND RESULTS

All the measurements were done on the UV/VIS/NIR spectrophotometer UV 3600 from a Japanese manufacturer Shimadzu with an integrating sphere within wavelength area from 650 nm to 1000 nm. The UV Probe was used for results analysis.

Figure 1 shows the results of the 10 measurements of the Spectralon reference materials, so called X bar chart.

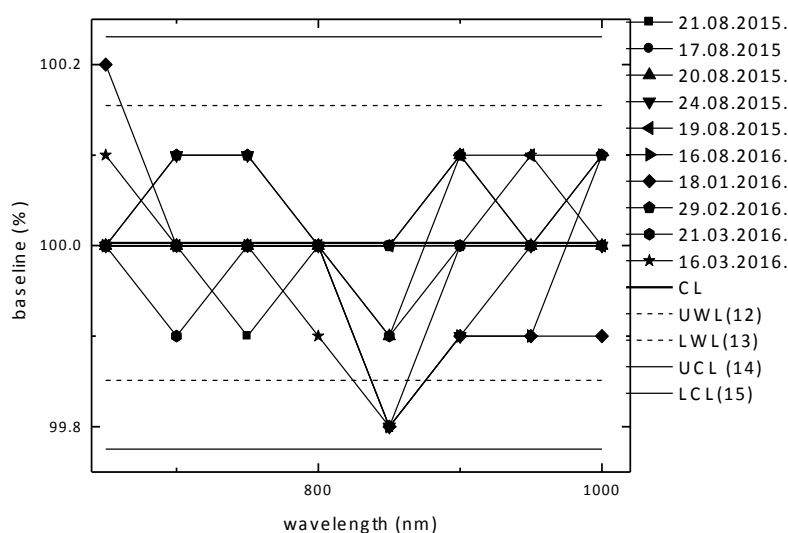


Figure 1. X bar chart of the method obtained by Spectralon measurements

After that a standard military cloth of Serbian Army, which has five color shades (light green, beige green, dark green, brown and black) was tested. Table 1 represents the values of standard deviations.

Table 1. Standard deviations for five shades of a standard military cloth of the serbian army

Wavelength (nm)	Black tone	Brown tone	Dark green tone	Beige green tone	Light green tone
	Standard deviation (%)				
650	0,09	0,3	0,5	1,0	0,7
700	0,1	0,5	0,4	0,6	0,5
750	0,1	1,0	0,6	1,0	0,9
800	0,1	1,0	0,6	1,0	1,0
850	0,1	1,0	0,7	1,0	1,0
900	0,1	1,0	0,8	1,0	1,0
950	0,2	1,0	1,0	1,0	1,0
1000	0,1	1,0	1,0	2,0	2,0

In the end interlaboratory comparison was done with the “Vinca” Institute for Nuclear Sciences and the results are represented in the Figure 2.

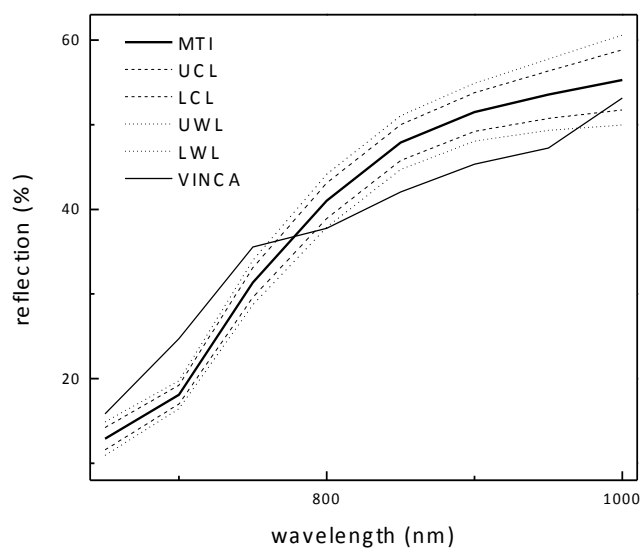


Figure 2. X bar chart of the method obtained by control sample measurements

3. CONCLUSION

To conclude, the Z score was calculated. The values ranged from -0.71 to +0.71, which was satisfying regarding interlaboratory measurements rules and therefore we could regard this method applicable for diffuse reflection measurements of textile materials.

4. REFERENCES

1. ASTM E903 (2012) Standard Test Method for Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres
2. Shimadzu, UV 3600 Tutorial, 2009.

Acknowledgement

This work was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia (project TR34034).