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The study of led lamp characteristics for administrative buildings from various manufacturers[1]

N. P. Nesterkina[1], U. A. Pil'shchikova[1]

Abstract. In this paper, the following characteristics of LED lamps in T8 flask from the following manufacturers are studied: ASD Russia, Smartbuy Taiwan, VOLPE China and fluorescent lamp PHILIPS Poland; characteristics - luminous flux, light output, color temperature, color rendering index, emission spectrum, light intensity curves. The studies were carried out at the measuring complex of Gooch & Housego company of the photocolorimetric measuring unit and the AC power supply unit DPS1060, the goniophotometric complex, TKA-PCM luxmeter-pulse meter and TKA-VD/02 spectrocolorimeter. They presented the results of experimental studies for the nominal electrical and lighting characteristics of radiation sources. The conducted studies of the purchased sample characteristics of the LED lamps ASD LED-T8R-STD 10 W 230 V G13 6500 K 800 LM 600 MM (Russia), Smartbuy SBL-T8-10-64K-A (Taiwan), VOLPE LED-T8-10 W/DW/G13/FR/FIX/N (China) showed that these types of lamps cannot be used for administrative building, kindergarten and educational institution lighting.

Key words. Light flux, light output, color temperature, color rendering index, emission spectrum, light intensity curves, lighting, administrative buildings.

1. Introduction

Currently, an increasing number of consumers prefer LED lighting, including the LED lighting for administrative buildings. There are lots of LED lamps in the Russian market. But it is difficult to choose a qualitative light source that would satisfy all the requirements [1–3] and regulatory documentation for lamps. Quite often the characteristics of a light source declared by a manufacturer do not correspond to their actual values. Three LED bulbs in the T8 ASD LED-T8R-STD 10 W 230 V G13 6500 K 800 LM 600 MM (Russia), Smartbuy SBL-T8-10-64K-A (Taiwan), VOLPE LED-T8-10 W/DW/G13/FR/FIX/N (China) flask were purchased for comparative studies at the retail trade network in Saransk, as well as a fluorescent lamp (FL) in T8 PHILIPS TL-D 18 W/33-640 flask that was manufactured in Poland [4, 5].

[1]Mordovian State National Research University named after N. P. Ogaryov, Saransk

Figure 1 shows the appearance of the studied LED lamps.

Fig. 1. The appearance of LED lamps in T8 flask

2. Materials and methods

The laboratory of "Lighting Metrology" Center (The Institute of Electronics and Lighting equipment of the Moscow State University named after N. P. Ogarev), performed the studies of LED lamp characteristics in a T8 flask with the power of 10 W as compared to the FL with the power of 18 W, similar to the studies of linear LED lamp characteristics [1]. The studies were carried out on the measuring complex of "Gooch & Housego" company, which includes the photometric ball OL IS 7600 with the diameter of 2 m, the spectroradiometer OL 770 VIS/NIR, the precision direct current source OL410-200 PRESISION LAMP SOURCE for an auxiliary lamp supply. The time of electrical parameters and the light flux stabilization of the studied lamps was the following: ASD LED-T8R-STD 10 W - 12 min, Smartbuy SBL-T8-10 W - 10 min, VOLPE LED-T8-10 W - 9 min and PHILIPS TL-D 18 W - 13 min. During the stabilization period, the lamp parameters reached their nominal values. At the same time, the value of the studied lamp light flux is reduced by 93 lm (11.2 %) for ASD LED-T8R-STD 10 W, Smartbuy SBL-T8-10 W - 49 lm (6.3 %), VOLPE LED-T8-10 W - 51 lm (6.4 %). But this does not create discomfort in lighting, as when you use the FL PHILIPS TL-D 18 W/33-640, which has the luminous flux of 809 lm at the moment of switching on, which makes 70 % of the nominal value, which is reached within 13 minutes. The studies of the following lighting characteristics: luminous flux (lm), correlated color temperature (K), color rendering index (Ra), as well as the emission spectrum were carried out using a photocolorimetric measuring unit and the AC power supply unit DPS1060, the goniophotometric complex, the

lux-pulse meter "TKA-PKM" and the spectrocolorimeter "TKA-VD"/02 [2].

3. Results

The results of electrical and lighting characteristic measurement at the rated voltage of the supply network showed the following: the luminous flux value was 754.3 lm for ASD LED-T8R-STD 10 W, instead of 800 lm declared by the manufacturer, the correlated color temperature was 6491 K instead of the declared 6500 K, color rendering index was 72, instead of the declared 80. For Smartbuy SBL-T8-10 W, the luminous flux value was 724.3 lm, instead of 1100 lm declared by the manufacturer, the correlated color temperature made 6260 K instead of the declared 6400 K, the color rendering index was 72 instead of the declared 80. For VOLPE LED-T8-10 W the luminous flux value was 729.5 lm, instead of 900 lm declared by the manufacturer, the correlated color temperature was 6362 K instead of the declared 6500 K, the color rendering index was 72 instead of the declared 80. Finally, for PHILIPS TL-D 18 W, the luminous flux value was 1156.6 lm, instead of 1200 lm declared by the manufacturer, the correlated color temperature made 4037 K, instead of the declared 4000 K, the color rendering index made 61 instead of the declared 63. The spectral distribution of radiation sources are shown in Figs. 2–4.

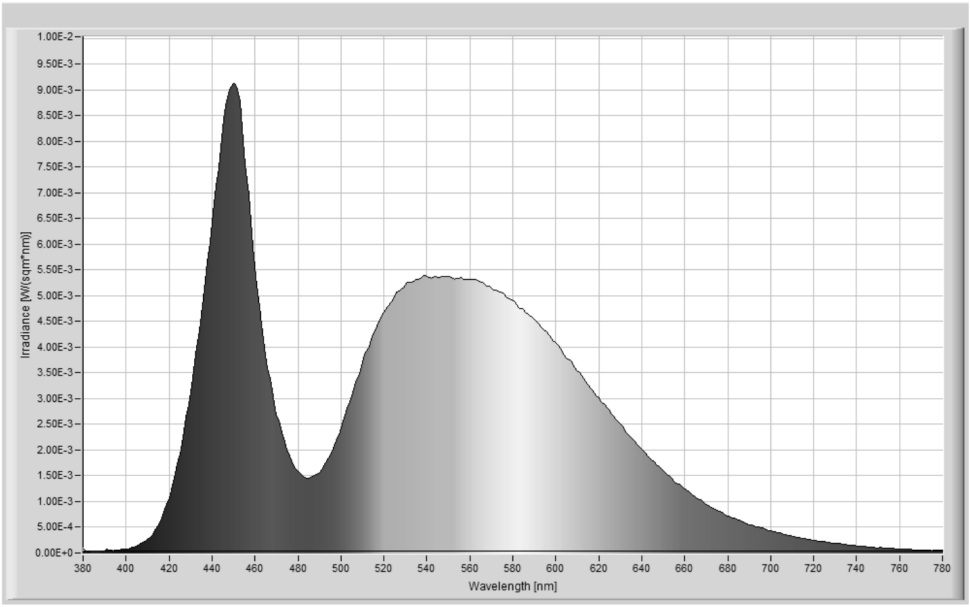

Fig. 2. LED lamp emission spectrum

The analysis of the results showed that the LED lamps have a continuous emission spectrum with the maximum in blue and yellow-green regions of the spectrum, which corresponds to the color temperature of 6500 K. The continuous spectrum of FL has separate lines with the emission maximum in the blue, green, yellow and red regions

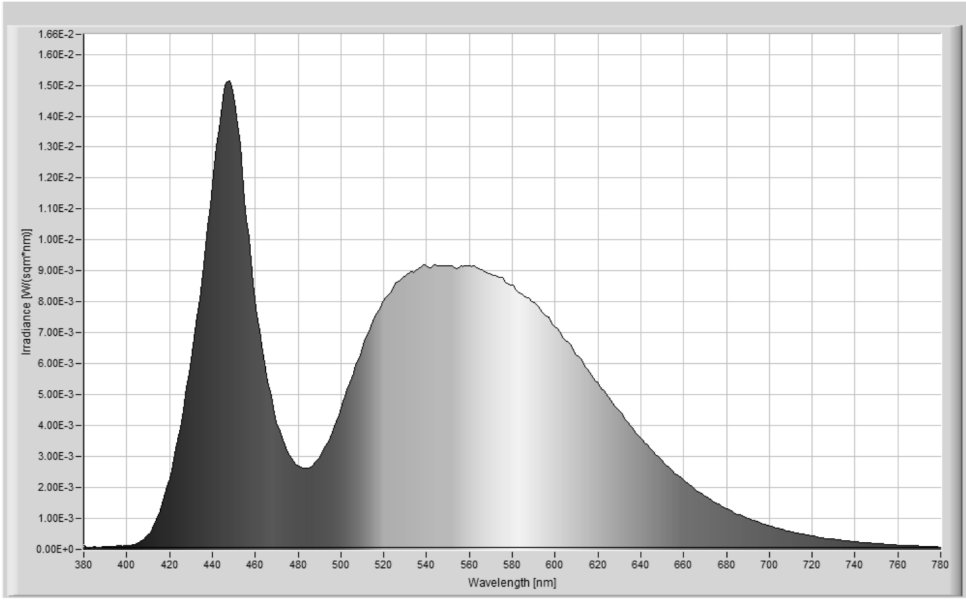

Fig. 3. LED lamp emission spectrum: Smartbuy SBL-T8-10-64K-A

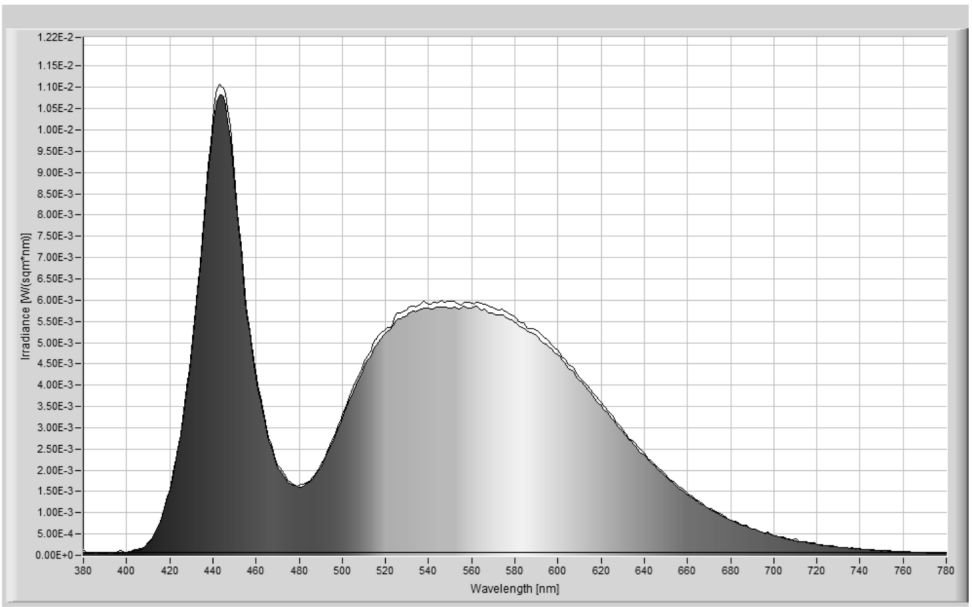

Fig. 4. LED lamp emission spectrum: VOLPE LED-T8-10W/DW/G13/FR/FIX/N

of the spectrum, which corresponds to the color temperature of 4000 K.

The light intensity curve (LIC) or the light intensity distribution in space was

determined on the goniophotometric complex at the rated voltage of 220 V for the lamps under study. The LIC of the lamps under study are shown in Fig. 5.

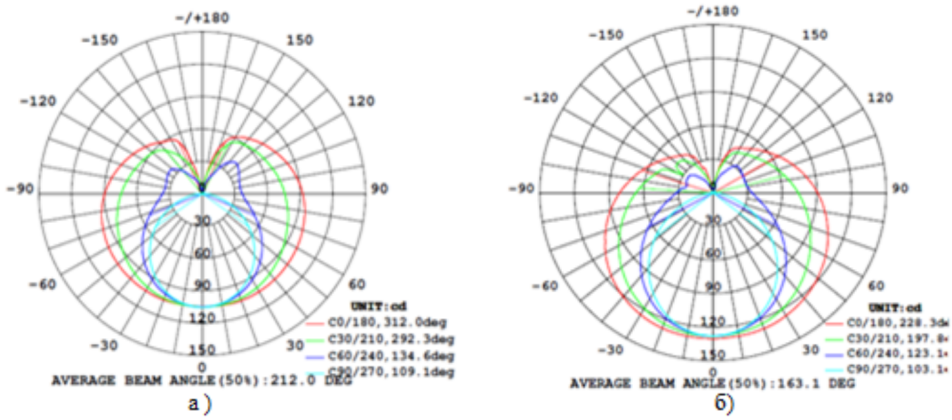

Fig. 5. Spatial distribution of LED lamp light intensity: left–ASD SD LED-T8R-STD, right–Smartbuy SBL-T8-10-64K-A

4. Conclusion

The luminous flux of the lamps under study is lower than the declared values: ASD LED-T8R-STD 10 W by 46 lm (5.7 %), Smartbuy SBL-T8-10 W by 376 lm (34.1 %), VOLPE LED-T8-10 W by 71 lm (7.8 %) and PHILIPS TL-D 18 W by 44 lm (3.6 %).

The measured correlated color temperature of the lamps under study ASD LED-T8R-STD 10W and LL PHILIPS TL-D 18 W almost does not differ from the declared values, and the corresponding temperature of the lamps Smartbuy SBL-T8-10 W, VOLPE LED-T8-10 W differs from the stated values and the difference makes 140 K.

The color rendering index of all LED lamps under study is lower than the declared values (72 instead of 80).

FL color rendering index is also slightly lower than the declared value.

The light distribution of LED lamps is directed mainly to the lower hemisphere and is in a large viewing angle, the maximum luminous intensity makes 110–130 cd.

The light distribution of the fluorescent lamp PHILIPS TL-D 18 W in 0–180 ° plane has a cylindrical shape, that is, FL radiation is distributed into the environment.

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