ECONTECHMOD. AN INTERNATIONAL QUARTERLY JOURNAL – 2017. Vol. 6. No. 3, 71-76

Research of characteristics of modern electric light sources at the example of led lamp

Stepan Khimka

Lviv National Agrarian University
St. Vladimir the Great 1, Dubliany, Ukraine. E-mail: stepanhimka@gmail.com

Received July 14.2017: accepted September 11.2017

Abstract. In this article we consider the questions of studying the characteristics of modern light sources on the example of LED lamps (LED).

The problem of energy savings gained weighty significance in recent years, particularly in the light. In many developed countries as a way to reduce power consumption the replacement of incandescent lamps to LED is considered.

LED are advanced energy efficient lamps, but much of the lamps that are coming on the inner market of Ukraine do not correspond to the declared lighting and electrical parameters. That is why we investigated LED lamps of such brands as «AUKES», «OK», «Iskra», «Lemanso» if they are in accordance with lighting and electrical parameters.

The results of the study indicate that among the investigated parties of lamps value for active power of all the producing capacity does not meet the stated on the package.

On the basis of experiments we also determined the dependence of illuminance E, Lx of voltage U, V. On the basis of this study we can say that most of LED lamps when changing the voltage in the range of 180 -240 V LED illumination is proportional to approximately 1% (± 0,2%) with a change in voltage at 1%.

As we have seen from the research the alleged power LED lamps does not match the experimental data, in some cases more than 30% - LED (AUKES).

A major drawback of LED, that enter the market in Ukraine is a low power factor, which varies between 0,51-0,63 further reduces technical and economic parameters of power supply and increases electric gates.

Key words: LED lamps, lighting, light output, power factor.

FORMULATION OF THE PROBLEM

Using light sources is associated with the regular consumption of electric energy, so specifications light sources have a special place in their quality assessment. Given the fact that today in industry 20% of the lighting is consumed and private sectors and administrative offices - up to 50% of the light, the qualitative characteristics of the light sources not only affect energy consumption, but also directly determine the economic impact to this consumption. Particularly acute, this problem arises in the context of a constant increase in the cost of electricity for consumers, setting limits on consumption and strengthening regulations and electricity use at work and at home.

So we decided to investigate experimentally the electrical current available light sources, for example LED lamps for direct replacement of incandescent lamps. [1-5]

ANALYSIS OF THE LATEST RESEARCHES AND PUBLICATIONS

According to many publications, the main barrier that hinders more widespread adoption of LED lamps for lighting is their high cost compared to incandescent lamps (10-20 times). But in addition to high prices for LED bulbs there are still many problems that hinder increasing use of LED lamps for lighting:

- inconsistency of some parameters of LED lamps consumers' expectations (design, dimensions, chromaticity, brightness, etc.).
- poor quality LED lamps and some manufacturers will not warranty the performance of replacement LED lamps in case of premature failure.

According to some authors [1-10], today the main obstacle that hinders the replacement of incandescent lamps to LED lamps is their quality.

Thus, according to various sources [1-3, 6-18] lamps of famous foreign companies such as «Philips», «Osram», «General Electric», correspond to declared in catalogs information and have a good quality. As for production in China, which comes under various brand names, it is common batch of poor quality that do not comply with regulations.

Therefore, the problem of quality, reliability and safety of new light sources, is very important. [8-10].

SETTING OBJECTIVES

The aim of this study is to elucidate the role of qualitative characteristics of light sources used in their future consumers, comparison the actual performance characteristics of the light sources, and also to identify potential economic benefits from using of substandard products.

The sequence of the study is:

1. To gather pilot scheme (Fig. 1).
2. To investigate the work of lights with oscillating voltage from 200 to 240, in the range of 10 V. Data amperage I, A; Power P, W; Illumination E, Lx add to the table.3. To determine the light output of the light source H

(Lx/W) depending on voltage. Total power S, VA, depending on supply voltage. Power factor cosφ depending on supply voltage.

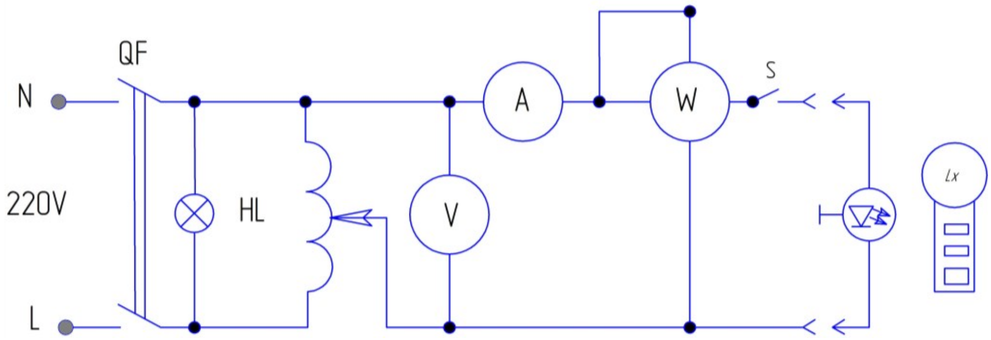

Fig. 1. Scheme study electrical sources of external lighting: QF - circuit breaker; HL - LED indicator; V - voltmeter; A - ammeter; W - wattmeter; S - key

PRESENTING MAIN MATERIAL

We researched LED lamps of trademark «AUKES», «OK», «Iskra», «Lemanso» declared in accordance to lighting and electrical parameters. For the study three samples (sample) were formed, for 3-4 LED lamps each. Comprehensive study the basic characteristics of LED – bulbs we produce according to the method [5].

Manufacturers submit the following characteristics of light sources:

- LED «AUKES» - 9W, 6400K, 600 lm, lifetime of 30,000 h.;
- LED «AUKES» - 9W, 4100K, 720 lm, lifetime of 20,000 h.;
- LED «OK» - 9W, 4200K, 700 lm, lifetime of 20,000 h.;
- LED «Iskra» - 8W, 4000K, 615 lm, lifetime of 25,000 h.;
- LED «Lemanso» - 10W, 6500K, 800 lm, lifetime unreported

Table 1. Results of research LED lamps

Lamps	Voltage U, V	200	210	220	230	240
1	2	3	4	5	6	7
LED «AUKES» 9W. 6400K U ignition 145V U attenuation 140V	Current I, A	0,0875	0,098	0,1	0,1	0,1
	Power P, W	9	10,5	11	12	13
	Lighting E, Lx	925	945	950	940	925
	Light output H, Lx/W	102,77	90	86,3636	78,333	71,153
	Total power S, VA	17,5	20,58	22	23	24
	Power factor cosφ	0,51429	0,5102	0,5	0,52174	0,54166
LED «OK» 9W U ignition 120V U attenuation 110V	Current I, A	0,095	0,095	0,095	0,093	0,09
	Power P, W	10,5	10,7	11	11	11,5
	Lighting E, Lx	765	780	780	775	765
	Light output H, Lx/W	72,857	72,897	70,909	70,454	66,521
	Total power S, VA	19	19,95	20,9	21,39	21,6
	Power factor cosφ	0,552	0,5363	0,52631	0,5142	0,5324
LED «Iskra» 8W U ignition 50V U attenuation 140V	Current I, A	0,083	0,08	0,075	0,075	0,075
	Power P, W	9,2	9,5	10	10	10,5
	Lighting E, Lx	700	710	730	740	735
	Light output H, Lx/W	76,08	74,7368	73	74	70
	Total power S, VA	16,6	16,8	16,5	17,25	18
	Power factor cosφ	0,5542	0,5654	0,60606	0,5797	0,5833
LED «AUKES» 9W 4100K U ignition 145V U attenuation 140V	Current I,A	0,08	0,085	0,09	0,092	0,091
	Power P, W	9	10	11	11,5	12
	Lighting E, Lx	950	1000	1000	1020	1010
	Light output H, Lx/W	105,55	100	90,909	88,695	84,166
	Total power S, VA	16	17,85	19,8	21,16	21,84
	Power factor cosφ	0,5625	0,5602	0,555	0,543	0,5494
LED «Lemanso» 10W U ignition 35V U attenuation 40V	Current I,A	0,08	0,08	0,08	0,08	0,08
	Power P, W	10	10,2	10,5	11	11,5
	Lighting E, Lx	1050	1115	1240	1275	1290
	Light output H, Lx/W	105	109,313	118,09	115,90	112,173
	Total power S, VA	16	16,8	17,6	18,4	19,2

Continuation of Table 1

1	2	3	4	5	6	7
	Power factor cosφ	0,625	0,60714	0,59659	0,59782	0,5989
Mean values	Lighting E, Lx	878	910	940	950	945
	Power P, W	9,54	10,18	10,7	11,1	11,7
	Light output H, Lx/W	92,033	89,390	87,850	85,58	80,769
	Total power S, VA	17,02	18,396	19,36	20,24	20,928
	Power factor cosφ	0,560	0,553	0,552	0,5484	0,559

The results of measurements and calculations will be considered on the dependency charts (figs 2-5).

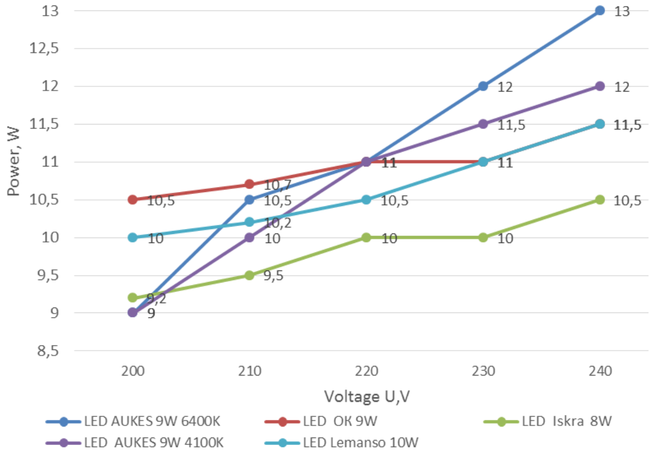

Fig. 2. Results of research of power from voltage

As can be seen from the study, the claimed power of the investigated LED lamps does not correspond to the experimental data, in some cases exceeds more than 30% - LED (AUKES).

The criterion of energy efficiency is the light return of the lamp. The effectiveness of the various designs of the investigated LED lamps is graphically depicted in Fig. 3

More effective is the design of the lamp, in which the light output at the nominal voltage of the supply has the maximum value. This criterion corresponds to the bulb of the brand Lemanso. The rest of the lamps had a decrease in light output with an increase in voltage to the nominal, which is a negative indicator. This is confirmed by the results of the measurements given in the table.

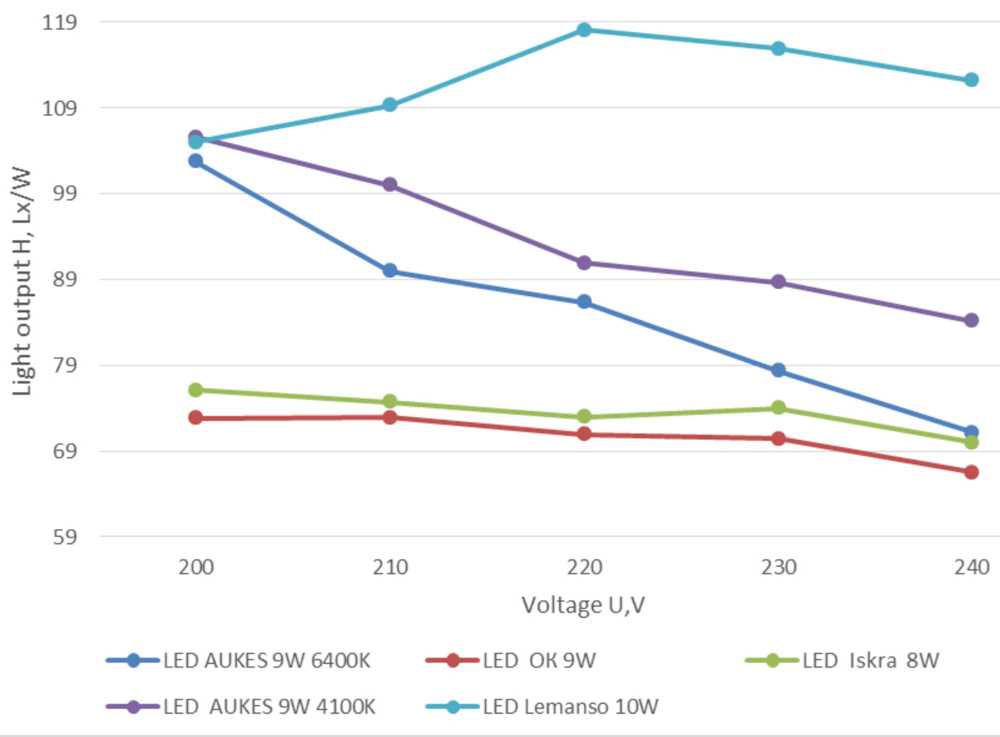

Fig. 3. Results of studies of light output from voltage

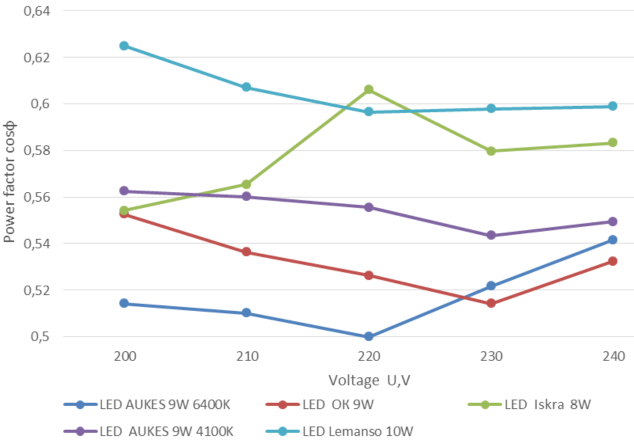

Fig. 4. Results of the research of the power factor from the voltage

A significant drawback of the LED lamps that are supplied to the Ukrainian market is the low power factor φ. The power factor of the LED lamps we are investigating fluctuates within 0.5-0.63, although according to the Cabinet of Ministers of Ukraine dated October 15, 2012, No.992, the minimum allowable values of the power factor for LED lighting equipment for indoor lighting of public and industrial buildings by the power of 5 to 25 W must be not less than 0.8. The low power factor of the lighting equipment data requires additional compensation of the reactive power of the lighting network, in order to increase the technical and economic parameters of the electricity supply, as well as to reduce electricity losses [17-19].

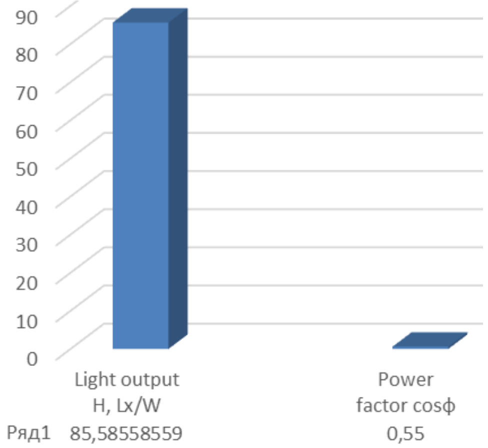

Fig. 5. Averaging the results of studies on light output and the power factor of the voltage

The averaged values of light output showed a rather high result compared with other existing light sources today, it is 85.58 Lx / W compared with 12.8 Lx / W in incandescent lamps, which is almost seven times higher. But the power factor of these lamps needs to be significantly increased..

CONCLUSIONS

LED bulbs are promising energy-saving lamps, but a significant part of the lamps entering the domestic market of Ukraine do not correspond to the declared light engineering and electrical parameters. As we see from the research, the claimed power of the investigated brands of LED does not correspond to the experimental data, in some cases exceeds more than 30.

In turn, for light output at nominal voltage of 230 V, the LED lamps can be rotated in the following curtain:

1. LED «Lemanso» – 10W, 6500K – 115,9 Lx/W;
2. LED «AUKES» – 9W, 4100K – 88,69 Lx/W;
3. LED «AUKES» – 9W, 6400K – 78,333 Lx/W;
4. LED «Iskra»– 8W, 4000K – 74,0 Lx/W;
5. LED «OK»– 9W, 4200K – 70,454 Lx/W.

A significant drawback of LEDs entering the Ukrainian market is the low power factor, which varies within 0.51-0.63 which further reduces the technical and economic parameters of electricity supply, as well as increases the loss of electricity.

Based on the above, one can understand that for the expansion of the market of energy-saving light sources, in particular LEDs, it is vital to ensure their high quality. To do this, it is necessary to restrict access to non-quality products through the system of technical regulation to the Ukrainian market.

REFERENCES

1. **Khimka S., Sosnowski S. 2016**. Control lighting by means of virtual control measurement device. Motrol Vol.18 № 8. 85-89.
2. **Khimka S. M., Goshko M.O. 2015**. Investigation of the characteristics of modern electric light sources on the example of compact fluorescent lamps. Motrol Vol.17D № 4. 61-65. (in Russia)
3. **Sirotyuk V.M., Khimka S.M. 2011.** Experimental study of energy-efficient modes of vibration of the dispenser loose forages. MOTROL №13D. 62-67. (in Ukrainian).
4. **Yatsun A.M. 2013.** Power of consumption and phase displacement between voltage and a current of the covering ring capacitor transducer over a conducting plate. Motrol. vol. 15 206-211.
5. GOST 17616-82. 1982. Lamps electric. Methods of measuring electric and light parameters. - M .: Publishing standartov. 46. (in Russia).
6. **Khimka S.M., Goshko M.O., Vasiliv K.M. 2012.** Investigation of the characteristics of modern electric light sources. Bulletin of Lviv National Agrarian University "Agrotechnical research" №16. 56-62. (in Ukrainian).
7. **Sorokin V.M. 2009.** LED lighting is expands the boundaries. SvitloLyuks №2 37-41. (in Ukrainian).
8. **Vasilega P.O. 2010.** Electrotechnological installation. Publisher Sumy Sumy State University, 548. (in Ukrainian).
9. **Ivanov V. 2007.** Poltava standard metrology, new opportunities to protect consumers of lighting products. Standardization, certification, quality. №5. 67-71. (in Ukrainian).
10. **Władysław Dybczyński. 2007**. The LED intensity curve. «Electrotechnical Overview». Vol. 1k. 14-16. (in Poland).
11. **Zbigniew Siemion. 2004.** Photometric, colorimetric and spectroradiometric LED measurements. «Electrotechnical Overview» Vol. 5. 455-458. (in Poland).

12. **Kovalchuk I.M., Barhatov O.M. 2013.** Development and evaluation of the effectiveness of LED lighting technology of the house commercial flock of laying hens. TGATU work. 336. (in Ukrainian).
13. **Jacek Chęciński, Zdzisław Filus. 2016** LED lamp with color temperature control. «Electrotechnical Review» Vol. 9. 51-54. (in Poland).
14. **Ptak P., Górecki K., Zarębski J. 2017.** Power supplies used in LED lamps. «Electrotechnical Overview». Vol. 3. 167-171. (in Poland).
15. **Light's Labours Lost – Fact Sheet**. Intenational energy agency http: // www. iea. org/ publications/ freepublications/ publication/ light_fact.pdf.
16. Four Great Reasons to Dim Lutron Electronics Available online at: http: //europe. lutron. com/ dim. htm.
17. **Khimka S. M. 2012.** Grounding the parameters of the vibrating batcher of friable forages. Manuscript. LvivNAU. 130. (in Ukrainian).
18. **Eisenberg Y.B. 2007.** Energy conservation - one of the most important problems of modern lighting technology. Light engineering №6. 6-10. (in Ukrainian).
19. **Sirotyuk V.M., Khimka S.M. 2014.** The results of experimental studies of energy-efficient doser of loose feed. **MOTROL** Vol.16D № 4. 148-156. (in Russia).
20. **Ivaniv V. 2007**. Poltavastandartmetrolohiya: new opportunities for consumer protection lighting products. Certification, quality.№5. 67-71. (in Ukrainian).