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INFLUENCE OF LIGHT SOURCES FOR AMBIENT LIGHTING UPON VISUAL TASK PERFORMANCE, IMPRESSION AND TIREDNESS : COMPARISON BETWEEN LED AND FLUORESCENT LAMPS

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The comparison between the LED lamp and the fluorescent lamp as the source of ambient lighting is done considering the aging. The influence of the sources upon the distinction of the detail and the color, the visual task performance, the impression and the tiredness feeling are examined. Subjects are 13 young persons, 4 middle age persons and 7 elderly persons.

There is no difference by the source in the distinction of the detail and the feeling of tiredness. There is not a remarkable difference by the source even in the impression either. For the young person, the visual task performance of the LED lamp is more slightly higher than that of the fluorescent lamp. Oppositely, the color discrimination of the fluorescent lamp is better than that of the LED lamp. In each evaluation, neither the middle age person nor the elderly person has the difference by the source of the young person.

Keywords: LED, fluorescent lamp, ambient lighting, visibility, performance, impression, tiredness, age

1. Introduction

Technological of the light source development is advanced. LED was used chiefly for the display up to now. However, it will spread as the lighting source with features such as long life, the power saving, and low generation of heat in the future.

To examine effectiveness as the lighting source of LED, this paper reports on the experiment result about the influence of light sources upon the visual task performance, the impression and the tiredness feeling from the aspect of comparison between the LED lamp and the fluorescent lamp as the ambient lighting source

2. Experimental condition

Experimental room is the size with width of 2.7m, depth of 2.7m, and height of 2.6m, the average reflectance of the wall is 0.73 (white), and the room is uniformly illuminated with the luminous ceiling setting LED lamps or FL (= fluorescent) lamps.

Correlated color temperature of LED is 7400 K and 5400 K, and that of FL is 6700 K and 5000 K. Three wavelength type FL is used. Figure 1 shows the relative spectral power distribution of each source. The illuminance on the task used to experiment is set to 1.0, 10, 100, 500 and 1800 lx in each lamp.

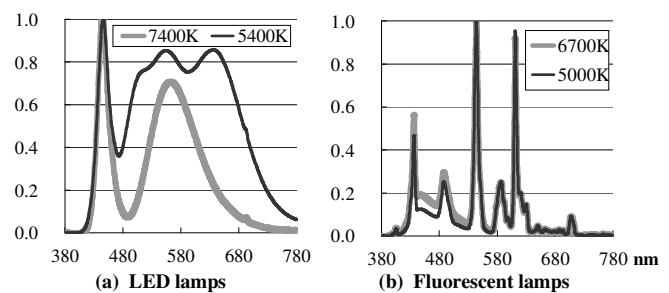


Figure 1 Relative spectral power distribution

The experiment is composed of two kinds (Experiment A and Experiment B).

(1) Experiment A :

Subjects are 7 young persons aged 21 to 36 years old. The memo work of 90 minutes is done under each lighting condition, and before it works and after it works, each measurement and evaluation is done. The content of experiment is 1) Amount of memo of 90 minutes, 2) Visual acuity by Landolt ring, 3) Focus adjustment ability (Pericenter distance), 4) Color distinction (100 Hue Test), 5) Visual task performance (Cancellation test), 6) Calculation speed of 100 pairs (addition of two digits) ,7) Discomfort glare, 8) Impression of space by the semantic differential method of seven stage scale, and 9) Tiredness feeling.

(2) Experiment B :

To examine the influence of aging, the same measurement as Experiment A except the memo work of 90 minutes is done by using 17 persons with different age who are 6 young persons , 4 middle-aged persons, and 7 elderly persons.

3. Results and Discussion

About the result of experiment A by using 7 young persons, it is judged that there was a difference between the source of light, if 5 persons showed the same tendency and if there was a significant difference in the dangerous rate 10%. The following results were obtained.

- 1) About the amount of the memo and 100 mass calculation that only the performance is requested, the effort of LED is better than that of FL.
- 2) The record of cancellation test that the visual acuity and the performance are requested is depending on the visual work load, and there is no superiority or inferiority between LED and FL.
- 3) In the color distinction (100 hue test), LED is inferior to FL. Moreover, the individual variation is large, and the degree of that is different depending on hue.
- 4) There are correlations in the error score of the 100 hue test and the color difference of 100 hue test chips. The reason why LED is inferior to FL is that the color difference of the test chip by LED becomes small more than FL.
- 5) The pericenter distance both of LED and FL is short in a high color temperature, that is, the focus adjustment ability is high in a high color temperature.
- 6) In visual acuity, there is no difference by the light source and the correlated color temperature.
- 7) About the impression evaluation of "intellectual" " safety" and "brightness", there is some difference between the light sources.
- 8) The difference between the light sources is not admitted in the tiredness feeling by the judging standard used in this paper.

The result of experiment B is still examining. However, about the middle age and elderly, in the visibility and in the visual performance, the difference by LED and FL is not seen compared with young person.

References

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