

Comparative study of the psychological effects of the spectral distribution of daylight and LEDs in office spaces

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1. INTRODUCTION

- It is not always possible to provide sufficient daylight to the people in closed spaces or office spaces.
- New technologies with LEDs could be useful for this situation, but there are not enough data for judging this.

2. PURPOSE

- To compare the psychological effects of daylight and LEDs.
- To confirm whether it is possible to reproduce the effect of daylight by using LEDs.
- This study focuses on the spectral distribution.

→ Compare **daylight**, **LED A** and **LED B** at the same CCT and illuminance.

3. EXPERIMENTAL METHOD - experiment of daylight and LEDs -

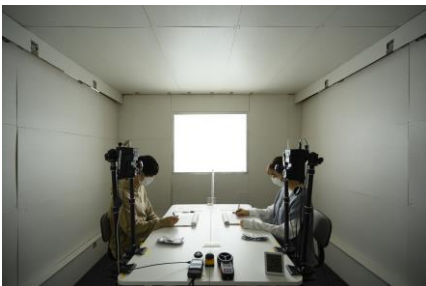


Figure 1. The experimental space.

- There were 18 subjects in total.
- The experimental space has the opening screened by a diffusion filter to compare each light source.
- Lighting conditions; **5500K 120lx**, **5500K 300lx** and **5000K 2000lx** at the eye level.
- Psychological evaluations of lighting environment, atmosphere, fatigue and workability were performed during the experiment.

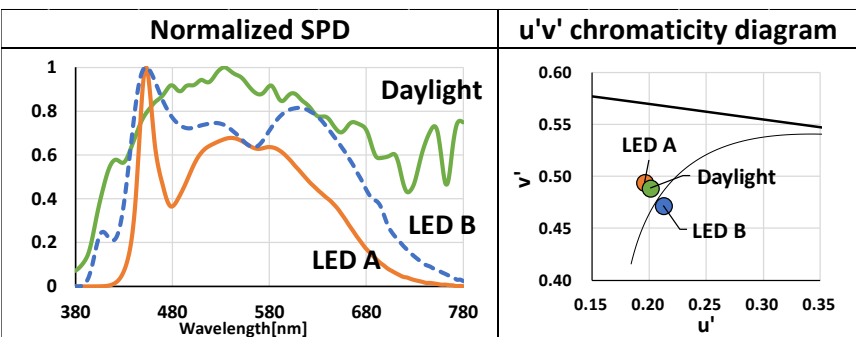


Figure 2. Spectral distribution and $u'v'$ chromaticity under 5500K 300lx.

4. RESULTS & DISCUSSION - comparison of psychological evaluation -

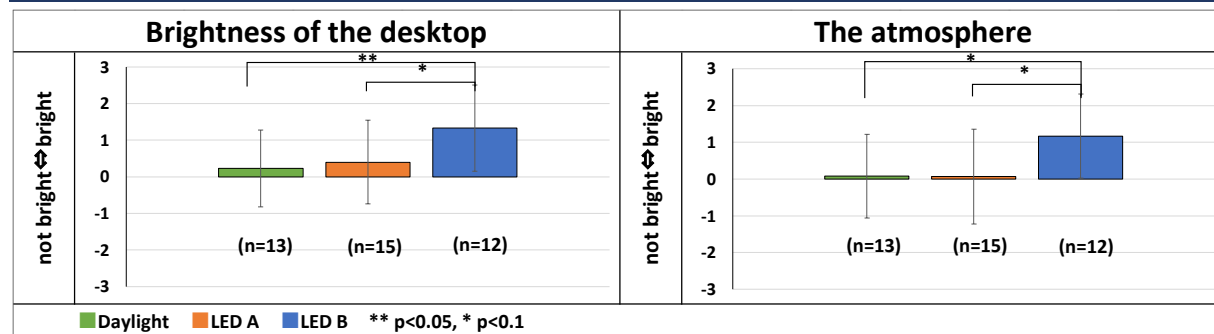


Figure 3. The result of psychological evaluation of each light source under 5500K 300lx.

5500K 300lx (Figure 3.)

- **LED B** was evaluated **brighter** than daylight and LED A.
- There was **no significant difference** between daylight and LED A.

→ The chromaticity of LED B is on the blue side from the black body locus while the chromaticity of LED A is closer to that of daylight (Figure 2.).

< Results of other conditions >

5500K 120lx: **Daylight** was evaluated **more positively** than LED A in the items of atmosphere such as “warmness” and “stability”.

5000K 2000lx: There was **no significant difference** between daylight and LED.

→ The difference in chromaticity is more likely to appear in lower illuminance.

5. CONCLUSION - effects of spectral distribution -

- There is no difference in the psychological effects among daylight and LEDs when their chromaticity values are close.
- To reproduce daylight by using LEDs, it is necessary to equalize their chromaticity values in addition to the CCT and illuminance at the eye level, especially in case that the illuminance is low.