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Backlight Module Design in Traditional Chinese Medicine Inspection Environment

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Abstract: This article is under the guidance of TCM theory, the backlight module technology applications at the Chinese Wang detection standard light source environment design, environmental design requirements based on traditional Chinese medicine by inspection standards, optimized backlight module assembly and structure, the ultimate purpose of the building used to simulate the human eye, in line with the requirements of Chinese medicine by inspection standards light in the environment, the research for traditional Chinese medicine by inspection for objective research by inspection instruments, such as acne, pigmentation, skin and palm prints standard environment designed to provide research ideas and technical support. It also laid a good foundation for the backlight module technology more widely used in medicine.

Key words: Backlight module technology, traditional chinese medicine, inspection

INTRODUCTION

Traditional Chinese medical inspection diagnosis is mainly distinguished by doctor's visual inspection and experience and the diagnosis results are limited by knowledge level, thinking capacity and diagnosis skills of the doctors, as well as influenced by external objective condition like light and temperature, so it is short of constant objective evaluation standard and the doctors cannot have consistent determination results of inspection diagnosis as well as brings lots of difficulties for inspection diagnosis research, teaching and remote diagnosis, which can not be objective and compared. Setting a set of objective and standardized acquisition standard can reduce error but also get precise and stable inspection diagnosis image, offer accurate data for subsequent image analysis, as well as is good for establishing standard image database of traditional Chinese medical inspection diagnosis (Gong *et al.*, 2012a). Current traditional Chinese medical diagnosis device light source mainly adopts point light source or strip source, whose color rendering property and evenness is pretty bad. The research has optimized BLU module and structure guided by traditional Chinese medicine and based on demands for traditional Chinese medical inspection diagnosis standard environment design and finally constructed standard light source environment applied in simulate human eye function and meeting demands for traditional Chinese medical inspection. Part of research report is as follows.

BLU DESIGN IN TRADITIONAL CHINESE INSPECTION DIAGNOSIS STANDARD ENVIRONMENTAL DESIGN

BLU module mainly consists of six structures involving incident light source, light guide plate, reflector plate, diffuser plate, prism plate and polarizing reflector plate. The research divides reflector plate into back light reflector plate and light source reflector through rational selection of material and structural design, uses light source reflector to substitute prism plate and polarizing reflector plate, thus BLU mainly concludes four parts (five structures) in the research.

Incident light source

Light route design of LED incident light source: The research uses LED as incident light source and lateral illumination method as microstructure design. It can break internal transmission resulted by total reflection effects through reflecting film and diffuse reflecting film and then make incident light scattering property.

Evenness design of LED incident light source: The research uses LED incident light source as surface light source and constructs a space back light unit structure, actual working scope is 300×980×200 mm, the material is PMMA, reflecting rate $n = 1.49$ and optic properties of all the st evenness of combination test surfaces of light guide plate definite smooth optic surface with 95% transmission rate and the reflective rate of reflector plate shall be 98%, namely lambertian scattering type.

Table 1: Comparative results of light guide plates

Parameters	Screen printing	Laser crossed	Laser pointed	Nanometer processed
Raw material	Acrylic plate	Acrylic plate	Acrylic plate	Acrylic plate
Influence on color temperature	<200	<200	<200	<200
Influence on color rendering index	<2	<2	<2	<2
Whether in accordance with compatibility standard	Yes	Yes	Yes	Yes
Evenness property	Better	Better	Better	Good

Table 2: Comparison of main properties of design sample machines of two shapes

Parameters	Arc structure	Flat plate structure
Light guide plate processing	Bend one light guide plate	Link three flat light guide plates
Box size	Smaller	Bigger
Box structure	Stable	Not stable
Surface evenness of light guide plate	Even	Even
Photograph human facial evenness	Arc light guide plate design, consistent to human facial shape and make all human facial areas equal to illumination intensity received	Hard to take photos and bad evenness of human facial areas
Visual effect	The whole set of light guide plate, good visual effect	Bad visual effect
Scrubbing for disinfection	Easy to scrub for disinfection	Hard to scrub for disinfection
Illuminating efficiency	High solar energy utilization rate	Easily leak the light at the joint and lose Solar energy

Table 3: Color temperature and illumination intensity of sample machine and sunny morning indoor natural light

Parameters	EV	T	Δuv
Sample machine	3,001	5,109	0.050
Natural light	3,059	4,972	0.060

Light guide plate

Material selection: Select high color rendering LED as experimental light source and take comparative analysis for physical parameters of common light guide plates including screen printing light guide plate, laser crossed light guide plate, laser pointed light guide plate and nanometer light guide plate in the market. The result shows (Table 1) that light guide plate of different thickness influences the color temperature within 300 K, which is of normal error scope and the light intensity is proportional to the thickness. With LED of the same number, 10 mm nanometer light guide plate gets 3,188 Lx illumination intensity and highest light utilization rate as well as makes full use of solar energy, so it is considered as the best choice in traditional Chinese medical light source environment design.

Property of light guide plate of different shape:

Measurement result shows that arc light guide plate is better even than straight plate which is mainly resulted by weak closure, influence of external colored light and no light reflection at the joint of light guide plate. Presently, back light source generally adopts straight plate structure while this instrument adopts 3D structure and arc structure with several advantages (Table 2), so it would be the ideal design to combine incident light source into arc structure design of light guide plate.

Reflecting film and diffuse reflecting film: Consistent with light guide plate selection standard, the research select the reflecting film with good light reflection

characteristic, which can improve light energy utilization rate and evenness at most. The research test shows that reflecting rate of glass reflecting film is larger than 95% and of total reflective film in theory, illumination intensity is far higher than other reflective film and light utilization rate is the highest, so it could be considered as the best material choice in the back light design.

Diffuse reflective film, also named as diffuse film, is mainly applied in traffic sign and advertising sign. Nanometer light guide plate adopted in the research use internal diffusion method, good light guide property and high evenness, therefore diffuse reflective film is only set on the bottom surface of light guide plate to substitute diffuse plate and prism plate. As the outermost layer, light guide plate is easy to scrub, disinfect, beautiful and it has the same effect as that of matching diffuse plate and prism plate as well as saves the processing technique and cost.

BLU INSPECTION DIAGNOSIS ENVIRONMENTAL TEST RESULT

BLU parameter measurement results after combination are as following: Illumination intensity is 3,001 Lx, color temperature is 5,209 K, color rendering index is 92.7% and standard whiteboard evenness difference is less than 10%; It gets good total evaluation in measurement data and it nears the best natural illumination environment (Table 3, Fig. 1 and 2).

Set Kodak standard grey plate for correction and exposure respectively in the photograph opening of the two darkrooms and then take the pictures. Use image

X = 0.3514 _{.1}	Dominant wavelength: _{.1}	573.1 nm	Rendering index _{.1}	R1 = 91 _{.1}	R6 = 90 _{.1}	R11 = 92 _{.1}
Y = 0.3605 _{.1}	Colour purity: _{.1}	13.6% _{.1}	Ra = 92.7 _{.1}	R2 = 95 _{.1}	R7 = 97 _{.1}	R12 = 59 _{.1}
U = 0.2122 _{.1}	Peak wavelength: _{.1}	453.5 nm _{.1}	Luminous flux ϕ = 5.77 Lm _{.1}	R3 = 91 _{.1}	R8 = 90 _{.1}	R13 = 95 _{.1}
V = 0.4899 _{.1}	Half width: _{.1}	26.1 nm _{.1}	Radiant flux ϕ = 19.46 mW _{.1}	R4 = 93 _{.1}	R9 = 72 _{.1}	R14 = 94 _{.1}
CCT = 4804k _{.1}	Red percent: _{.1}	19.2% _{.1}	_{.1}	R5 = 91 _{.1}	R10 = 83 _{.1}	R15 = 92 _{.1}

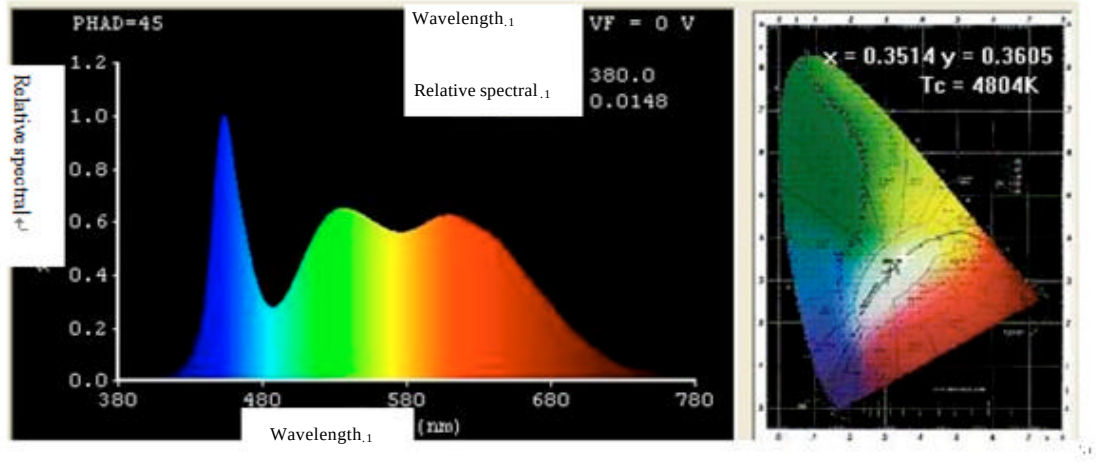


Fig. 1: Color rendering index and spectrum distribution R13 and R14 are skin colors and their color rendering properties are 95 and 94, respectively

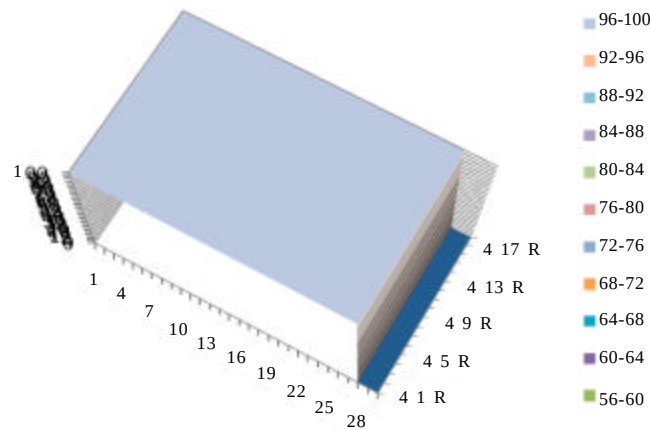


Fig. 2: Sample machine photograph opening evenness

processing software Adobe Photoshop to obtain 1×1 cm grey value crossed points in the picture (Gong *et al.*, 2011), draw distribution map and measure illumination intensity evenness of facial opening.

Sample 24-color card and OECF are consistent (Fig. 3 and 4) with the similar curve distribution and

it is certified that standard light source environment designed is stable, camera photograph parameter sets reasonably and photograph effect is pretty good. Reasonable standard acquisition environment design can effectively improve accuracy of software automatic color distinguishing and analyzing capacity as well as brilliance.

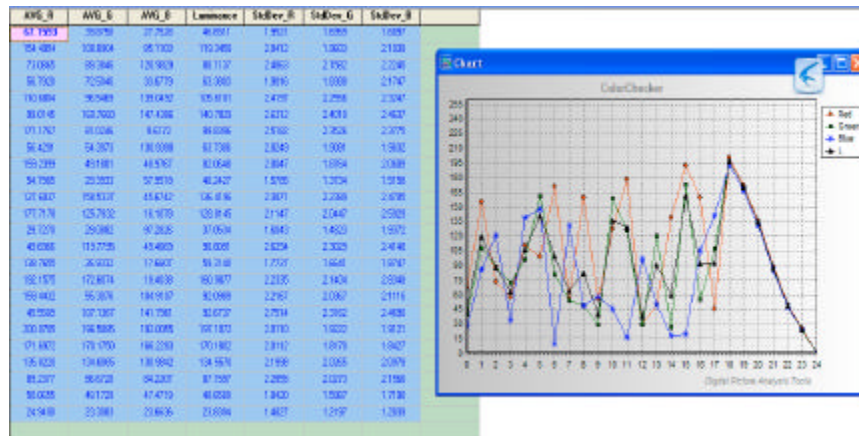


Fig. 3: Sample machine 25-color card color distribution map

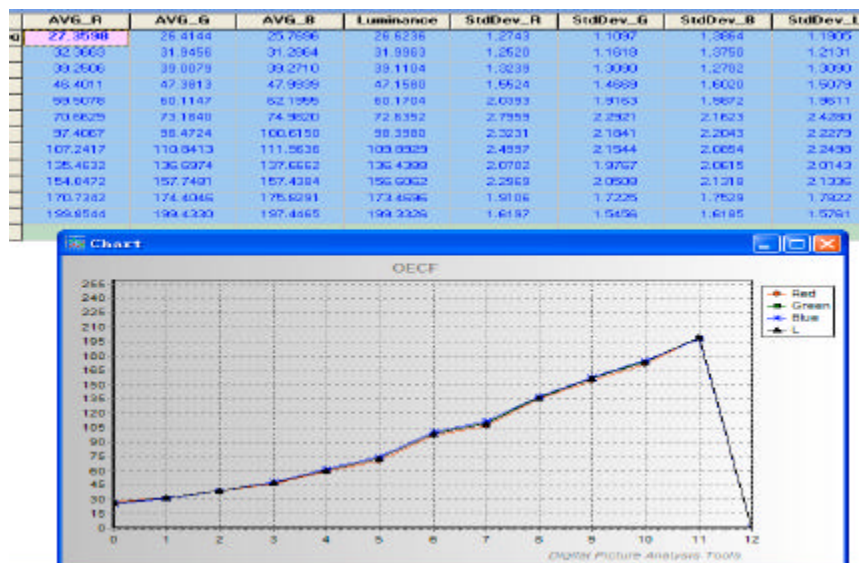


Fig. 4: Sample machine OECF curve diagram

DISCUSSION

Which artificial light source is more suitable for traditional Chinese medical inspection diagnosis shall be discussed and the best environment for traditional Chinese medical inspection diagnosis shall be tested (Gong *et al.*, 2012b). The research combines subjective evaluation with objective measurement and offers objective standard for selection and evaluation of artificial light source. Two key parts in BLU design of tongue and facial test system are: firstly, turn point light source into even facial light source and meanwhile ensure necessary

color reducibility and light energy utilization rate; secondly, the research plans to build a space light source environment with facial light source as background light (Wang *et al.*, 2010a, b) and how to design light guide plate shape, light distribution method and space structure makes BLU design of the task more complex and important. The task firstly has good understanding of back light technology general condition and application process and then makes experimental design scheme in accordance with traditional Chinese medical inspection diagnosis requirements. It adopts progressive selection and polynomial fitting method in terms of back light

accessory selection, makes proper design and distribution on the surface of light guide plate of different size, different shape and different thickness as possible as it can, then combines BLU design, machine visual technology and computer image processing technique effectively, finally obtains traditional Chinese medical inspection diagnosis standard environment with even and soft brilliance, good color reducibility and high light energy utilization rate. In addition, this research can offer research idea and technical support for objective standard environmental design of other inspection instruments in traditional Chinese medical inspection diagnosis like acne, stain, skin and palm print, meanwhile it sets good foundation for wider application in traditional Chinese medicine of back light unit technology.

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