ARTIFICAL LIGHT IN INTERIOR DESIGN AND ITS EFFECTS ON PLANTS USED

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ABSTRACT

Light, especially sunlight, plays an important role spiritually and materially in our lives today. In the interior design, artificial light is used since the sunlight is not enough for all dimensions of the space and the activities are limited to the morning hours. All plants need for light as an energy source of Photosynthesis. In the lack of light, nutrient material decreases gradually and plant dies. Plants have an inclination to face to the source of light and only in such a case they become lively and tall. Especially, they leave their old leaves. Mottled plants may turn into green. On the other hand, if the plants are subject to extreme light, they incline to get burnt, discolored and contorted. As a resulting order to grow up the interior space plants successfully, the light requirements and light levels of specific plants must be very well determined. While assessing the light, three reasons, duration, quality and intensity of light must be focused. Main purpose of the interior space landscape design primarily is to create appropriate spaces for the human comfort. For the plants, creating human-centered space is more dominant than space design. Plants produce nutrients and make photosynthesis for further living and for light assistance and chlorophyll. Light is important for the chlorophyll that is necessary for photosynthesis. Stomas on the leaf affect photosynthesis. Stomas let gas exchange on the leaf and they need light to achieve this. While stomas are open on the light they are closed in the darkness. It consists of wavelengths between 430-700 nm. The light comes from the sun is preferred since the light that the plant requires is given from a wide spectrum. In this research primarily interior space landscape design, the importance of light, its aesthetic and functional characteristics will be emphasized. Interior space landscape design criterions will be explained and the characteristics of

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the sources of lights that are appropriate for the plants' natural light requirements will be expressed. Also, while exhibiting plants in the interior space the duration and levels of sources of lights will be determined technically.

Key Words: Artificial light, Plant, Interior Space, Illumination

1. INTRODUCTION

To give place to plants in the interior space leans on prehistorical origin. Following the changes in living conditions and technical developments, the place is given to the plants in different places such as office, mall, hotel, hospital along with houses by diversifying the plants. Along with the positive effects of the plants using aesthetical characteristics, the ecological contributions of the plants are inevitable in giving place to plant as an architectural element in the places.

2. MATERIAL AND METHODS

Material of the study has been the publications on technical characteristics of light and its effect on the plants. It is benefitted from the studies on measuring the reflex against light strength, light duration and wave length depending on the physiological characteristics of the plants.
As the method of the study, generally the characteristics of the artificial light and its effect on the plants are examined paying attention to the concept of light, its vital effect on the plants, design with plants in the interior design and utilization of light.

3. LIGHT IN INTERIOR DESIGN

Light is also a construction material as concrete. This material represents its physical existence only when it is seen by any. It is the time when the light defines the place, represents surface patterns, displays the forms, specifies the scales and functions. (Kazanasmaz, 2003)
In the 20th century, scientists had many findings about the effect of light on the visual performance and color distinction. As specified in the studies, shining light prevents the secretion of melatonin hormone (sleep hormone) and makes the worker more active and careful. In case of dynamic light, suitable light strength and color during the day provides the brain not losing its activity.

3.1. Definition and goal of light and illumination

The irradiation of electromagnetic waves with wave length of between 380-780 nanometers the man's eye is sensitive to is called "light". The reason of not so accurate wave length is the eye differentiations in people as an essential item in light definition and also the effect of light strength on optic borders. Providing the visibility of an object or a certain neighborhood by sending light from a light source

is illumination. It also provides seeing the places and their objects in their natural size and color by natural and artificial illumination tools. Physiological, decorative and attractive illuminations are sorts of illumination in respect to its goal (Sirel 1997).

Luminous is grown out of a light with apparent and dominant direction, or a multi direction light or a combination of two sorts. It is the quality of luminous and is not related to fewness and plentifulness. Luminous may spread orderly in a place. It means that it is in the same level on each point. Or it is decreased and increased from place to place. It is also not related to fewness and plentifulness and order and variability is the quality. Luminous is gained using hot or cold or a combination of both and it is definitely the quality of luminous. The determination of luminous quality in a place is one of the basic illumination techniques.

The aim of illumination is to make visible the illuminated object and environment, not the source of illumination. The item being seen, in specific place, time, conditions and creating visual perception for specific aim may have so many different kinds. The man may be inside or outside the place of these objects. In order to see them in the best way, the quality and quantity of the luminous is so affective. The technique specifying how to illuminate, paying attention to these parameters is illumination technique.

Technically appropriate illumination; (Sirel 2001)

- Increasing the performance and operating speed in workplace
- Preventing the eye and neural tiredness
- Decreasing work accidents and energy consumption
- Increasing the succession in education institutions and similar places
- Providing the requested character in different indoor and outdoor spaces

3.2. What Is Light

Light is a form of electromagnetic radiation that is visible to the human eye. The radiation that we perceive as sunlight, or the visible spectrum, is a small fraction of the total electromagnetic spectrum that includes gamma rays, x-rays, and radio waves. Violet colored light rays at about 380 nm (nanometers) are the shortest wavelengths that humans can perceive in appreciable amounts, and red light wavelengths at about 720 nm are the longest. Solar radiation consists of a vast spectrum of electromagnetic wavelengths at various intensities. Visible light from the sun appears white due to the mixing of wavelengths that our eyes perceive. However, when passed through a prism or a mist of water droplets in the air, light waves become organized or refracted into visible bands of color producing a rainbow effect (Argus 2010).

3.3. The effect of the light on plant growing

The plant photosynthesizes by help of light and chlorophyll in order to sustain its life. Light is important for the chlorophyll which is required in photosynthesis. The stomas on leaves affect the photosynthesis. The stomas make possible the gas variation in leaf and light is needed for this purpose. Stomas are closed in darkness while they are open in light. Photosynthesis is increased, resolvable in water and it

composes more sugar with penetrating carbon dioxide while stomas are open. The plants transform energies from natural ways (sun light) and also artificial light (electronic lamps) to nutrition. They use energies with wave lengths between 400 and 800 nanometer (nm) in chlorophyll synthesis. White light is the visible part in energy spectrum and it includes wave lengths between 430 and 700 nm (Yazgan et. al. 2010).

Table1. Colors and wave length of light (Yazgan et. al. 2010)

Light	**Band(nm:nanometre=1x10-9m or milimicron=mμ) 1 milimicron is one per million of a milimeter.**
Ultra-Violet	< 380
Purple	380-430
Blue	430-490
Green	490-560
Yellow	560-590
Orange	590-630
Red	630-700
Infra-red	700-780

Human's eye can perceive the colors between purple and red. Blue, white and purple are required for the commencement of synthesis process. Crimson and infrared lights make extension and growth in different parts of the plants. They are also affective in blooming and forming fruits. Sun light is preferred because of giving the required light for the plant from a wider spectrum. Instead of light reflected from a unique resource, diffusely coming light is more beneficial for the plant in order to gain equal energy from whole sides. In this manner, the light can reach leaves below easily. However, in differentiations in seasons and in a day, the artificial light is used in case of light insufficiency (Atalay 2004).
Three approaches in illumination set aside with certain boundaries are named as;

- Providing visibility
- To gain a good vision
- Providing visibility as it must be (Sirel 2001)

3.4. Design and kinds of illumination

Illumination design is a science as well as being an art. It is a science since the need for factors specifying illumination amount and light quality which are quantitative. It is art since it is felt by help of sensations. Illumination design is the function of integration of two completely independent factors, perception and technology in a manner that does not have a similar.

3.5. Design techniques of illumination

Light is invisible till the time of beating a surface and shaping the environment. The factors for lightening of any space are as follows:

- Condition
- Function
- Quality and quantity of light

- Architecture and decoration
- Space atmosphere
- Relation with neighborhood

3.6. Kinds of illumination

- Task illumination
  It is very close to the task area and it provides high luminous levels. It is just concerning task area. In general, it is preferred in business areas and used accompanying with general illumination apparatus.
- Accent illumination
  It is created by a linear light in order to emphasize on an object or attract attention to a part in an area. It is an important kind of illumination which architect uses in order to strengthening a design element or any theme.
- General illumination
  It is a light as a ground or back ground one created to decrease the certain contrast between the light for doing visual affairs or for emphasizing on some objects. It provides an ordered and monotonous illumination by balanced level illumination (Atalay 2004).

3.7. Light-plant relationship in interior space

Sun light is reflected from window or roof. A 1/3 ratio of the sun light from the atmosphere and the part reflected from the earth is reflected from the window (Yazgan et. al. 2010)
The light coming from the atmosphere is required for lengthwise growth. The maximum affected area is in relation with window height so that the botanic material can benefit from the reflected natural light from the window. The area the plant benefits from the natural light is constituted with a 45 degree angle in artificial direction. Because of that, this area should be estimated in lightening and an artificial light must be planned where there is not any natural light. The density and effective area of the reflected light in the building are changed according to window dimensions, its material features and the climatic conditions (Yazgan et. al. 2010)

4. CONCLUSION

In the growing of plant, the density, duration and quality of the light are important. Light density; it must be measured of quantitative expression of light lux or in terms of lumen on square meter. Lumen is the amount of spreading light from light source. Lux presented the amount of light gained on surface. It is quantitative measurement. The demand of light density is different for every plant. The bright light is 53500-128400 lux in average. This amount is different according to height from the sea, season and time of the day. Most of the plants do not bloom in case of lack of light. The light below 1600 lx in interior space prevents blooming. However some kind, Spathiphyllum, is blooming in 1070 lx.

Light duration; it must be a balance between the light density and light duration so that the plant represents the most appropriate progress. Permanent artificial lightening does not have any benefit while the required light density is not provided. The resting periods of the plants and self-concerning needed photoperiods (lightening duration) of every plant and lightness and darkness duration affect the organism progress. The average lighting duration for the plants is as follows; the lightening duration is 8-12 hours darkness/day and 12-16 hours/day. If only the minimum light density is provided, the optimum light duration must be provided.

Light quality; light quality expresses the type of the gained reflected energy of the plant. The plants use the energy between the blue and red wave lengths. The visible light spectrum is the light between the wave lengths yellow and green. The lights with wave lengths between ultraviolet and infrared are also natural light resource. While excessive red light causes in a slim long stem, inadequate blue light causes in phototropism which means one way progress through light. Chlorophyll synthesis is in the highest level between blue light energy (400-475nm) and red light (625-675nm). The type of light resource changes according to the ceiling which means the distance between the plant and light. The ideal for the plant progress is natural light. Most of the electrical light sources are basically mono-chromatic. It can be benefitted from artificial light source when natural light is insufficient. White-hot, fluorescent and mercuric lamps can be used for this purpose.

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