CITY LIGHTS AND URBAN GREEN

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ABSTRACT. The city lights may cause more or less serious damages to the most of the tree close to the sources of the artificial light. In this paper[1] the emission spectra - 350 nm to 800 nm - of the lamps most used or recommended for city lighting have been analysed, and their emission spectra, together with the solar spectrum, have been compared with the absorption spectrum of the main plant pigments and the phytochrome.

1. Introduction

The city lights may cause more or less serious damages to the most of the tree close to the sources of the artificial light (as in avenues and parks) for what concerns the photosyntesis and photoperiod. In fact, the thermal radiation emitted by the lamps causes, in its surroundings, a favourable microclimate, that extends vegetative period of the branches and leaves more directly exposed to it. In addition, the light emitted by the incandescent lamps extends the length of the daytime to the whole day, and consequently increases the photosynthesis activity. Finally, the incandescent lamps stimulates the phytochrome activity in an anomalous way if compared with the length of the daytime, which alters the sprouting and the blooming. The above results are well evident, above all in the city avenues. Here, the branches situated in the lighted side of the tree are much bigger and are clearly leaning toward the source of the light.

2. Results

The emission spectra - 350 nm to 800 nm - of the lamps most used or recommended for city lighting have been analysed, and their emission spectra, together with the solar spectrum (fig. 1), have been compared with the absorption spectrum of the main plant pigments (chlorophyll a, fig. 7, chlorophyll b, fig. 8) and the phytochrome (R, fig. 9, FR, fig. 10). The outcomes show that the traditional incandescent lamps - the most similar to the composition of the solar spectrum - heavily influence, just for this reason, the biological activity of the plants. For this study, the following lamps have been taken into consideration:

a) Incandescent lamps, fig. 2

[1] This work was presented in Italian in Padua during the 2nd Congress of "L'Albero, l'Uomo, La Città" in september 1983 and printed in Giulini (1983)

FIG. 1

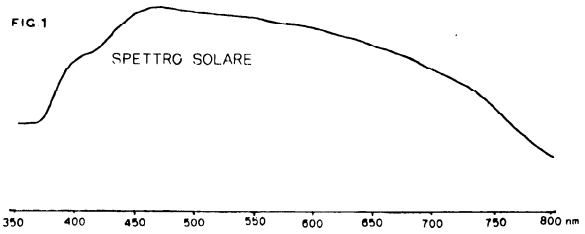


FIG. 2

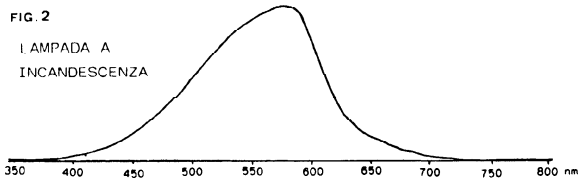


FIG. 3

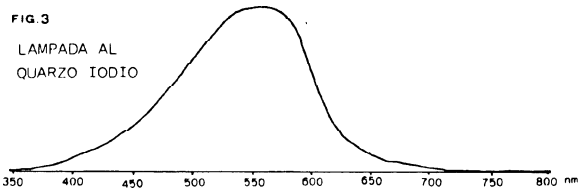


FIG. 4

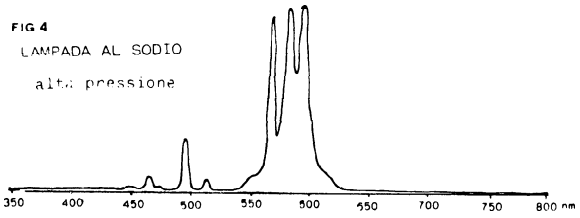


FIG. 5

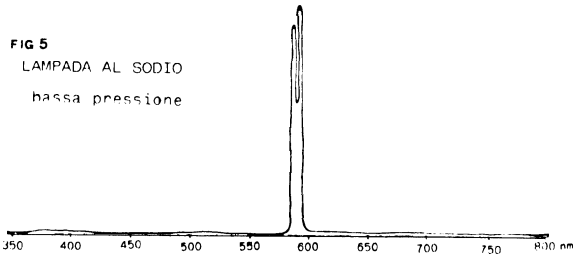


FIG 6
LAMPADA AL MERCURIO

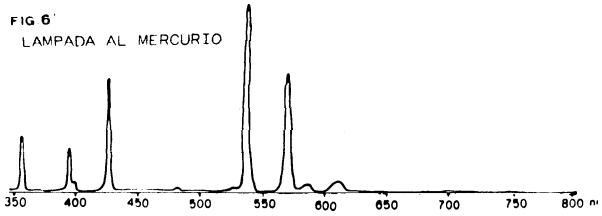


FIG. 7
CLOROFILLA a

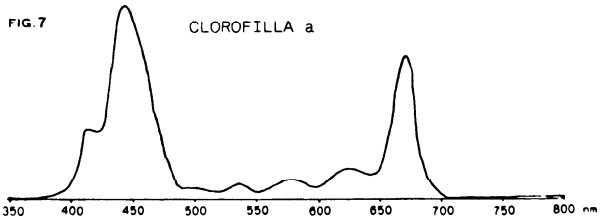


FIG 8
CLOROFILLA b

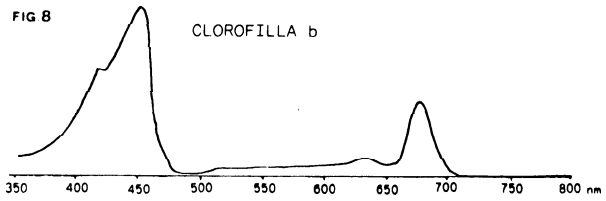


FIG 9
FITOCROMO R

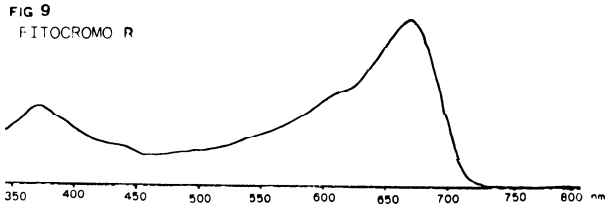
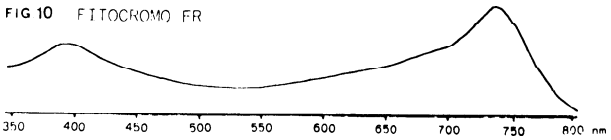


FIG 10 FITOCROMO FR



b) Iodine quartz lamps, fig. 3

c) High-pressure sodium lamps, fig. 4

d) Low-pressure sodium lamps, fig. 5

e) Mercury-vapor lamps, fig. 6

The results of the preliminary tests indicate that: a) and b) lamps cause evident reactions in the plants; the plants lighted up by c) and e) lamps react in an uncertain way; the plants exposed to the low-pressure sodium lamps seem to have no reactions to an extended exposure to these light sources. In short, the low-pressure sodium lamps appear to be the least harmful. These lamps, even if produce a "non-solar light", are likely the most suitable lamps to light up the brick monuments and to enhance their details. The mercury-vapor lamps, already widely used for their energy saving characteristics and the power of the emitted radiation, have a very low effect in avenue and park lighting in comparison with Incandescence and Iodine quartz lamps. Moreover, this kind of lamps has a relatively "white" emission that, even if "cold", is well suited to light up marble monuments and green-blue-brown coloured monuments, such as bronze statues, etc.

References

Giulini, P. (ed.) 1983, *L'Albero, l'Uomo, La Città*, Signum, Padua, 42-44.