

COLOUR RENDERING: AN OBJECT BASED APPROACH

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Light sources with limited spectral content cannot render colours correctly. Typical spectra of phosphor white and RGB LEDs often result in a low colour rendering index, in spite of a high appreciation of LED lighting in visual experiments.

The standard approach to colour rendering evaluation has always been based on a relative assessment: the colour coordinates of a set of standards samples are compared with the colour coordinates under a reference illuminant. Our work explores an alternative way for colour rendering evaluation based on an absolute evaluation of the source which, in our view, corresponds better to the circumstances encountered in practical situations. The basic idea is to do the referencing, not to an illuminant but to our visual representation of a number of familiar objects.

To this end a special viewing booth was constructed that allows a uniform LED illumination of non-planar surfaces. Specular reflections must be avoided because it is important that the test objects cannot reveal any indication about the colour of the lighting. Six Lamina power RGB LEDs were mounted around a diffusing tunnel in which the object is placed for observation. Additionally, a large, internally lit, background screen provides a constant adaptation field to the test subjects. In this way, changing the colour of the illumination is interpreted as a change in colour of the object itself. An extra constant external source provides a gloss effect which ensures a natural look of the object.

Most people have a pretty good idea of what fruit 'should' look like, so a green apple, yellow banana, lemon and orange were selected as test objects. To change the colour appearance of the objects, over 200 illumination conditions (6 red × 6 green × 6 blue) were selected. For each condition, the object colour was measured with a spectroradiometer. Several test subjects were asked to evaluate the acceptability of the test object on a 5 point scale while its colour was changed in a random order. The obtained acceptance volume was modelled by an three dimensional ellipsoid. These volumes can be used to quantify the colour rendering abilities of a light source.

The ultimate goal of this research is to introduce an alternative way of evaluating the colour rendering of light sources.

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