Artificial white light may become eye-friendly

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Courtesy of the Institute of Physical Chemistry
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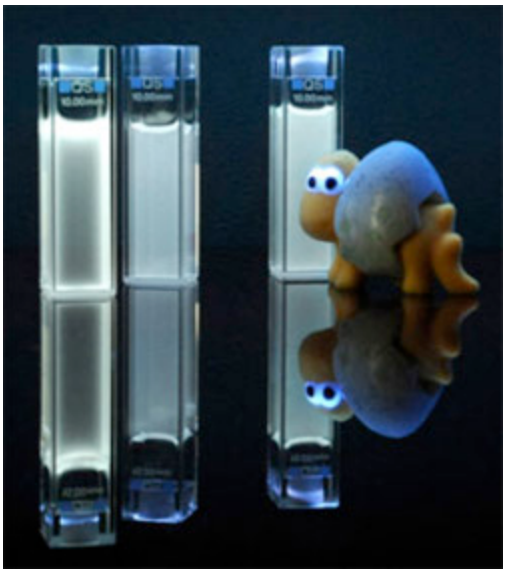
The harsh, artificial-looking light of today's energy-efficient light bulbs could become a thing of the past—replaced by natural-looking light, a group of scientists says.

The Polish chemists claim to have found a class of substances that make light which mimics sunlight in that its spectrum features a continuous blend of almost all visible colors. This is similar to the way sunlight is formed. In contrast, conventional energy-efficient bulbs such as fluorescent lamps and LED's emit only a handful of specific colors.



Bottles of a newly described, light-emitting substance next to a small toy. Polish chemists claim to have found a class of compounds that make light which mimics sunlight in that its spectrum features a continuous blend of almost all visible colors. However, the light emitted is not intense enough to be useful in everyday products yet, they say. (Image courtesy IPC PAS, Grzegorz Krzyzewski)

Either way, the colors combine to create white or whitish light, but in the second case the far more limited range of colors leads to a deader quality.

The new discovery involves "a class of organic molecules emitting white light with continuous spectrum covering almost the entire visible [color] range," explained Jerzy Karpiuk of the Polish Academy of Sciences' Institute of Physical Chemistry, who heads the research team.

Karpiuk stressed that it may be a long time before the findings lead to a useful product, partly because the light produced is weak. Nonetheless, the fact that it took only one, simple chemical to generate the white light is encouraging, he added.

White is a special color created as a result of mixing of light waves of all colors, or in scientific parlance, wavelengths. "Wavelength" literally means the length of the light wave required to create each specific color—the distance between neighboring wave peaks. Visible light comes from colors in the wavelength range from about 420 to 730 millionths of a millimeter.

The white from fluorescent lamps and similar artificial sources is created by the mixture of three colors: red, green and blue. These come mainly from emissions of specific hues from substances known as luminophores. It takes several substances to generate the light, making the products less efficient and harder to produce, according to Karpiuk and colleagues.

Karpiuk's group worked with crystal violet lactone, a substance produced in mass quantities and

used in copy paper as a so-called dye precursor. A molecule of it includes two structures called fluorophores that emit light: one blue, the other orange. But members of the research team found that by modifying the way that the molecule is energetically stimulated, varying hues can be emitted, to the point that a continuous spectrum and white light emerges.

Yet crystal violate lactone also has properties that make it un suitable for real-life use as a light source, the researchers said: the light is weak and light sources based on the molecule probably can't be efficiently mass-produced.

"However, the most important thing is that we managed to show that a certain concept works in practice," Karpiuk said; it's "only a matter of time before light sources recreating natural white light will be constructed." The findings are published in the research journal *Physical Chemistry Chemical Physics.*