'Lightbulb' molecule has a bright future

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A single molecule that reliably emits white light could speed the development of low-energy LEDs for the next generation of light sources and displays, say chemists.

Energy-efficient LEDs are widely tipped to become the predominant lighting source of the next decade and beyond, replacing the fast-disappearing incandescent bulb, as well as thecompact fluorescent lights that are replacing them.

Likely to become the standard in this area areorganic LEDs – thin films made from organic polymers that can be coated onto large areas at low cost. But generating white light from OLEDs is difficult as organic compounds within the films generate light only at very specific colours. Making white involves mixing two or more compounds to create a white light balance, and that drives up the price.

Jekyll and Hyde

Soo-Young Park at Seoul National University, South Korea, and colleagues at the University of Valencia in Spain, have created a molecule able to behave like two separate light-producing molecules. When stimulated with a voltage it produces orange and blue light that mix to create white.

Previous attempts using the same basic concept involved linking together two separate molecules into one. But, because energy is able to flow between the two molecular sub-units, one unit typically emits more light than the other, resulting in an unwanted tint.

The new molecule does not suffer that problem, and only contains one light-emitting chemical group. When connected to a voltage, this group switches to a high-energy form that emits blue light as it reverts to its original state.

Roughly half the time, though, the high-energy form picks up extra oxygen and hydrogen atoms, becoming a short-lived form that produces orange light before reverting to the original state.

A large population of the molecules reliably produces equal quantities of orange and blue light that mix to produce an even white.

Efficiency boost

"This allows us to create white emission in much the same way as creating white light from independent [lights]," says Park, potentially saving money and increasing efficiency.

"The science is excellent and very impressive," says Colin Humphreys who works on LEDs at the University of Cambridge in the UK. But, he adds, it needs an efficiency boost before it can be used in commercial lighting and displays.

Currently, the molecule converts electrons into photons at least 30 times less efficiently than commercial LEDs. Park responds that the study was more about proof of principle and that the efficiency figures will rise as the method is optimised.

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