Reducing Carbon Emissions Via Improved Streetlights

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Courtesy of SynEvol
Credit: King Abdullah University of Science and Technology

A recent research project carried out in partnership between King Abdullah University of Science and Technology (KAUST) and King Abdulaziz City for Science and Technology (KACST) illustrates how nanomaterials can significantly contribute to reducing the carbon emissions of LED (light-emitting diode) streetlights. The research group believes that applying this technology in the United States might lower carbon dioxide emissions by more than one million metric tons.

The main breakthrough is a nanomaterial known as nanoPE, which enhances thermal radiation from the LED surface, aiding i temperature. LEDs inherently produce heat, and high temperatures can harm their internal components and reduce their lon approximately 75% of the energy used by LEDs is eventually dissipated as heat. By decreasing this heat accumulation, nano efficiency and lifespan while notably lowering energy-related emissions.

The study leader, KAUST Professor Qiaoqiang Gan, stated, “LEDs are favored light sources due to their enhanced efficiency a minor enhancements can further improve them, which can significantly impact sustainability, as even small advancements h implemented widely," stated Gan. He mentioned that lighting accounts for about 20% of the world's yearly electricity usage nearly 6% of worldwide greenhouse gas emissions.

Dr. Hussam Qasem, General Manager of the Future Energy Technologies Institute at KACST and a contributor to the research greatly enhances LED cooling while preserving high illumination efficiency, positioning it as a promising option for sustainabl Arabia.”

Standard LED streetlights aim their light at the area to be lit up, which is the reason they face downward. They are also craft radiation remains contained within the LED. Conversely, streetlights covered with nanoPE are actually inverted so that they f the area that needs illumination.

This inversion occurs because NanoPE is engineered to allow infrared light, which primarily contributes to thermal radiation, reflecting visible light. The research indicated that over 80% of the infrared light released by LED streetlights enveloped in na through nanoPE and moves upward into the atmosphere. In comparison, over 95% of the emitted visible light reflects off nar ground, lighting up the area below.

NanoPE is derived from polyethylene, the most commonly manufactured plastic globally. To develop a nanoplastic that reflec (visible light) while allowing high wavelength light (infrared) to pass through, the researchers meticulously created pores as t 1000 times smaller than a human hair's thickness – within the plastic and also stretched and altered it into a thinner layer.