

Colour-changing nano pigment sensor

Chemists in South Korea have created a stable colour-changing sensor that displays an easily quantifiable response to the pH of its surroundings. Dong-Hwan Kim and colleagues at Sungkyunkwan University say their approach could pave the way for more reliable, affordable pH measurements across a broad range of real-world scenarios.

From environmental monitoring to medical diagnostics, pH is a vitally important indicator of health, quality, and safety. Currently, the most widely used tools for assessing whether an environment is more acidic (lower pH) or more alkaline (higher pH) are electrochemical sensors, which measure the potential difference between a pair of electrodes when immersed in a solution.

Although highly accurate and reliable, they are also rigid, vulnerable to electrical interference, and often difficult to apply in real-world measurements—such as in the microscopic environments of cellular interiors.

An alternative approach is to use colorimetric sensors: specially engineered dyes that vary the wavelength of visible light they absorb and reflect as pH changes, producing distinct colour shifts. These dyes can be embedded into a solid matrix to create colour-changing films, which can then be coated onto substrates to provide an ambient measure of the pH of their surroundings.

Yet although these sensors are far more flexible than their electrochemical counterparts, they come with their own drawbacks: including the leaching of dyes into their surroundings, and limited long-term stability. In addition, they often operate within a narrow pH range, making them less practical for applications requiring broad detection windows.

To tackle these challenges, Kim's team took a more in-depth approach to synthesizing a colorimetric indicator. They began by engineering nano pigments from two key components. The first was a class of molecules known as sulfone phthalein dyes—widely used in analytical chemistry due to their impressive stability, low cost, easily distinguishable colours, high reactivity, and relative ease of chemical modification. (Source Phys Org, J. Microsystems & Nanoeng. 2026)