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Organic near-infrared filter developed by NIIST team

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Can be used in night vision glasses and night photography

An organic filter that allows only near-infrared (NIR) light to pass through has been developed by scientists at the CSIR-National Institute for Interdisciplinary Science and Technology (CSIR-NIIST) based in Thiruvananthapuram.

The new NIR filter can be used for night vision glasses, night photography, and will have applications in security and forensics such as identifying blood stains on a dark fabric.

Currently available inorganic filters are expensive and brittle whereas organic filters are easy to process and flexible too.

The filter was prepared by mixing a black dye (diketopyrrolopyrrole or DPP) having an amide group that helps the molecules to be in close contact with each other and interact, leading to changes in their optical properties.

“The amide group helps in binding and self-assembly of the molecule leading to the formation of a soft organogel,” says Ayyappanpillai Ajayaghosh, Director of NIIST, who led the team of researchers.

Organogel is key

The organogel-based filter has the ability to absorb both ultraviolet and visible light while allowing the near-infrared light alone to pass through. The nanofibres formed through the self-assembly of the DPP molecules are responsible for the broad light absorption of the material, making it appear dark.

The researchers developed the filter by mixing the organogel with a transparent polymer (polydimethylsiloxane). The addition of the dye turns the transparent polymer into a semi-transparent one and the filter appears black as it absorbs most of the ultraviolet-visible light.

"Only very little of the organogel has to be added to the polymer to make the filter. The material is present throughout the polymer matrix even though very little is added," says Samrat Ghosh from the Chemical Sciences and Technology Division at NIIST and the first author of the paper published in the journal *Advanced Materials*.

The filter was found to absorb light from 300-850 nm (both ultraviolet, visible and a part of NIR light) and transmit NIR light from 850-1500 nm. The researchers tested it for night photography and found the filter responsive only to NIR light.

Dried blood stains on a black cloth that remained invisible to naked eyes became clearly visible and detectable when viewed through a camera with the NIR filter. Tampering of a cheque which was not discernible to naked eyes could be easily identified when viewed through a camera with the filter.

A potential application of the new material is in the design of hidden security codes on documents which can be viewed only through a NIR-readable camera.