A PAPER-BASED SENSORS FOR DETECTION OF EUTROPHYING NUTRIENTS IN WATER AND WASTE WATER SYSTEM

IITM Technology Available for Licensing

Problem Statement

- Installation and maintenance expenses associated with real-time water quality monitoring systems, especially in large watershed areas with limited wastewater treatment units, pose a significant challenge.
- Traditional methods such as spectrophotometric and electrochemical approaches face drawbacks, including low sensitivity, longer incubation times, decreased selectivity, and high fabrication and maintenance costs.
- **While colorimetric sensors offer rapid and reliable detection with the naked eye, their high cost, complicated synthesis**, and storage of reagents, along with complexities in on-site measurements, present obstacles that need to be addressed.
- There is a pressing need for the **development of low-cost colorimetric paper-based sensors** as a practical and affordable sensing tool.

Intellectual Property

- IITM IDF Ref. **2070**
- **IN 406442 - Patent Granted**

Technology Category/ Market

Environmental Monitoring & Water Quality Assessment

Applications- Water Quality Monitoring

Industry - Water & Wastewater Management

Market - The water quality sensor market size is estimated to grow at a CAGR of 6.72% between 2023 and 2027, and is forecast to increase by USD 1581 M.

TRL (Technology Readiness Level)

TRL - 4: Technology validated in lab scale.

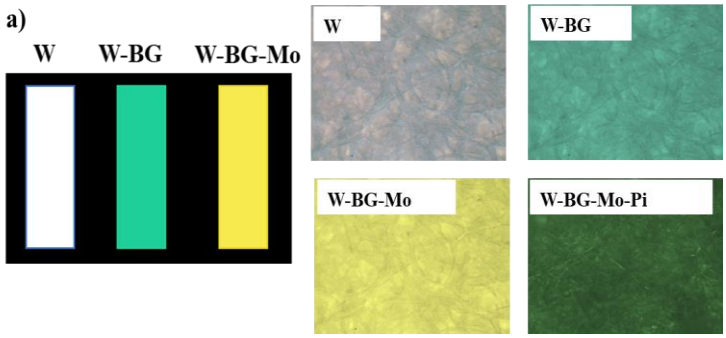

Fig. 1. Depicts the characterization of prepared strips. (a) visual (b) optical microscopic (W-Whatmann paper; W-BG- paper sensor coated with brilliant green; W-BG-Mo- paper sensor coated with brilliant green and molybdate ion); W-BG-Mo- Pi- paper sensor coated with brilliant green; molybdate ion in the presence of phosphate of ion).

Technology

The invention discloses a paper sensor for the detection of eutrophying nutrients in water and wastewater comprising a paper strip coated with Tween -20 and a probe.

The probe is a dye and is brilliant green. The paper sensor comprises a dye of concentration of 5 µM.

The paper sensor comprises the detection of phosphate ions, and the detection range of the eutrophying nutrient is between 0.07 mg/L and 13.6 mg/L.

The paper sensor stability is >90 days and stable at a temperature of up to 60 °C and up to a pH of 10 as measured by the grayscale intensity in the range of 125-130 by Image J software.

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Industrial Consultancy & Sponsored Research (IC&SR)

Key Features / Value Proposition

Affordability and Accessibility

•The low-cost nature of the paper sensor, coupled with the use of readily accessible chemicals, ensures a cost-effective solution for water quality monitoring.

Ease of Use

•The sensor's simplicity allows for easy deployment, requiring only a drop of liquid reagent or a simple dip of the strip, making it user-friendly even in resource-constrained environments

Naked Eye Detection of Pollutants

•By aligning with regulatory guidelines, the sensor enables the visual identification of pollutant levels, facilitating early detection and intervention to prevent water body deterioration

Selective Performance

•The sensor demonstrates selectivity in the presence of co-existing ions, ensuring accurate and reliable measurements in complex environmental samples.

Non-Toxic Byproducts

•The sensor's reaction produces no toxic byproducts, ensuring environmental safety and sustainability throughout its use.

Stability and Scalability

•With high stability under diverse environmental conditions and easy storage, the sensor can be reliably scaled up in production.

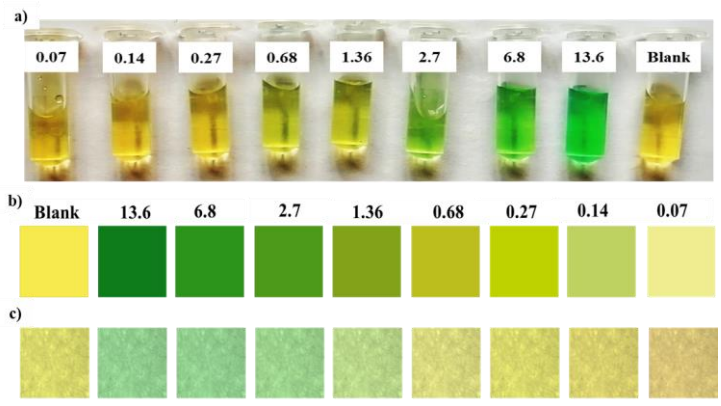

Fig. 2. Depiction of color change at different phosphate concentration. (a) Digital image of phosphate detection using probe in the liquid phase (b) Digital image of phosphate detection using paper-based sensor (c) Optical microscopic image of phosphate detection using paper-based sensor.

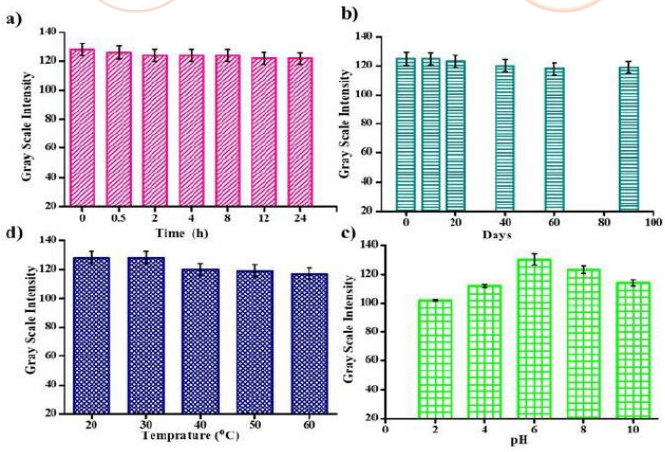

Fig. 3. Diagrammatic representation of the stability test of paper-based sensor. (a) leaching test (b) storability (c) effect of temperature (d) effect of pH with the grayscale value of strips.

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