

## Technical Brief

Ref No: Tech Brief/2022/10

### Colorimetric paper strip detector for detection of 2,4,6-TNP/Picric acid from water, soil and explosives

#### Technology Summary

Highly selective paper strip based kit for the colorimetric detection of 2,4,6-trinitrophenol.

#### Background

2,4,6-trinitrophenol (TNP) is widely used in many industries, and is the most common water and soil pollutant. TNP is extremely toxic, and detection of TNP with high selectivity and sensitivity is very important. Several methodologies based on spectroscopic and electrochemical techniques are available for TNP detection.

Fluorescence sensor techniques, based on fluorescence quenching in response to TNP, offer advantages of high sensitivity, cost efficiency, portability, and quick response. However, such sensors suffer from disadvantages such as fluctuations of background fluorescence. In contrast, colorimetric methods, based on a shift in the emission in the visible region, allows detection with the naked eye, simplifying the detection process. However, colorimetric detection of TNP with high selectivity and low detection limit remains a challenge.

#### Technology Description

Dr. Pramanik's lab at CSIR-CSMCRI has developed a paper strip based kit for the detection of TNP. The paper strip containing polymeric membrane was coated with a novel chromen-2-one derivative i.e (E)-7-(diethyl amino)-3-(4-9-dimethoxymethyl) styryl)-2H-chromen-2-one. Sample containing TNP was dissolved in acetonitrile. Dipping the coated paper strip in this solution facilitates the reaction between the novel chromen-2-one derivative and TNP, resulting in a change in color of the strip from green to yellow.

#### Market Potential

Global market size of explosive detectors is \$5.97 Billion in 2019 and forecasted to reach \$11.10 Billion by 2027 with CAGR of 8.2%. The highest share is accounted for by the Asia-Pacific region i.e.32.6% due to ongoing territorial disputes. Currently, bulk detectors dominate over the trace detectors segment, but the latter is expected to grow at the highest rate in the forecast period.

#### Value Proposition

- High selectivity for sensing 2,4,6-TNP over other nitroaromatic explosives
- Visual/naked eye detection
- Trace as well as bulk detection
- Low detection limit (micromolar range)
- Compatibility with membrane, cloth, paper
- Instant detection i.e. 1-2 sec
- Simple sample preparation method
- Portable detection kit as strips are of pocket friendly dimensions
- Affordable cost i.e. approximately 500 INR per unit
- Low chances of false positive results
- Pre-Blast and Post-Blast Investigative Tool
- Workable in all environmental conditions

#### Applications

Detection of explosives as TNP is used in the manufacturing of explosives. Useful for security systems at Public Places, Military & Defense, Cargo & Transport, Aviation, Docks, Law enforcement, Bomb squads and other private security, seaports, structures such as the government buildings and detection of traces of TNP in soil and water useful for Water, soil testing laboratories

#### Technology Status

- Demonstrated at lab scale - 1kg
- 1 mm films cast in lab
- Patent protected
- Seeking interested industry partners