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ORIGINAL ARTICLE

Fabricated CeO_2 nanopowders as a novel sensing platform for advanced forensic, electrochemical and photocatalytic applications

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Abstract In Forensic investigation, identification of various types of ridge details are essential in order to fix the criminals associated in various crimes. Even though several methods and labeling agents are available to visualize latent finger prints (LFPs) there is still simple, accurate, cost-effective, and non-destructive tool is required. In the present work, CeO_2 nanopowders (NPs) are prepared via simple solution combustion route using *Tamarindus indica* fruit extract as a fuel. The optimized NPs are utilized for visualization of LFPs on various surfaces by powder dusting method. Results revealed that visualized LFPs exhibit Level 3 features such as pores and ridge contours under normal light with high sensitivity and without background hindrance. The photometric characteristics of the prepared samples exhibit blue color emission and highly useful in warm light emitting diodes. The photocatalytic studies were carried out with different Methylene blue (MB) dye concentration and pH values. The obtained results reveal that the CeO_2 NPs exhibits an excellent catalytic properties which can act as a good catalytic reagent. The findings demonstrate that the prepared NPs are quite useful as a labeling agent for visualization of LFPs, efficient catalysts for dye degradation as well as solid-state lighting applications.

Keywords *Tamarindus indica* · Latent fingerprints · Solution combustion route · Photoluminescence · Photocatalytic activity

Introduction

Fingerprints (FPs) have provided a vital source of forensic evidence for human identification and individualization. The patterns on the FPs are individual to each person and remain same throughout lifespan. Normally most of FPs seen in the daily life is latent and invisible to naked eyes; as a result, some certain methods are necessary to recognize personal identification in forensic science. Till date numerous methods (chemical, optical) have been established to recognize LFPs. However, the recognition was restricted only level 1 and level 2 ridge details due to the poor image qualities (Saif et al. 2015; Sharma et al. 2014; Wang et al. 2015a, b, c).

Further, the level 1 and 2 features are easily forged, by the generation and use of artificial skin imprints. However, the analysis of level 3 features required some efficient nano powders with uniform particle size and morphology (Basavaraj et al. 2017; Dhanalakshmi et al. 2017; Venkatachalaiah et al. 2017). Hence, there is an urgent need to progress a simple and efficient route in developing LFPs with superior sensitivity, little background, extraordinary efficiency, lesser toxicity and stress-free detection of LFPs, which is the essential requirement for forensic

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