Fluorescent Optical Sensor for Smart Detection of Nanoparticulate Pollutants in Workplaces

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The increasing use of nanomaterials in industrial settings raises critical concerns about their potential impacts on occupational health and safety.[1,2] Several studies have shown that the introduction of these materials into the workplace may lead to adverse effects and health risks for exposed workers.[3] Consequently, ensuring their safe use and production is essential. In this sense, this study presents an innovative sensing approach to detect hazardous nanomaterials in the workplace, focusing on the development and validation of an optical sensor for the detection of nanoparticles (NPs). Based on a previously patented fluorescence-based detection system,[4,5] the sensor is being adapted for large-scale implementation using commercially available nanomaterials. Specifically, carbon dots (CDs), graphene quantum dots (GQDs), and water-soluble organic dyes with characteristic blue and green emissions were selected and dispersed in an aqueous polyvinyl alcohol (PVA) solution. The resulting sensing films were deposited on cellulose filters compatible with INAIL-DiMEILA's experimental setups. Preliminary results suggest that the dimension of the NPs influences the optical response, supporting the sensor's potential selectivity for detecting nanoparticulate pollutants. Fluorescence quenching was observed both with a spectrofluorometer and under UV light, enabling the use of a colorimetric approach for smart sensing of NPs.

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4. Papadopoulou E., et al. *Sustainability*, *13*, 11896, 2021.
5. Athanasiou A. et al. *Method for the detection of nanoproducts*. United States patent application US 2024/0159679, 2024.