

Carbon nanomaterials can detect explosives

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Nanomaterials have unique electrical and optical properties. Due to these properties, nanomaterials show high potential for explosive trace detection. Nanotechnology plays an important role in the development of sensors. Therefore, nanomaterials can be used to produce selective, sensitive, simple and cost-effective sensors. The high surface area and improved surface activity of nanosensors provide higher signal-to-noise ratios. The signal has high electrical and optical properties and hence can be used for the detection of highly sensitive molecules. Carbon, metal and porous materials are usually used for developing electrochemical nanosensors. Additionally, carbon-based nanomaterials, such as carbon nanotubes, graphene and carbon nanoparticles are used in the sensors. These carbon-based nanomaterials have properties, such as chemical inertness, low cytotoxicity, high biocompatibility and unique electronic properties. Carbon-based nanomaterials are also used as energy storage materials. Further, graphene has bonded carbons and properties like fast conductivity, increased elasticity, large surface area and high mechanical strength. Graphene oxide is used as an oxidised derivative of graphene for the detection of nitroaromatic explosives. Graphene-based nanosensors are constructed by electrochemical reduction of graphene oxide onto a glassy carbon electrode using the square-wave stripping voltammetry technique. Graphene-based electrochemical sensors are also used to detect 2,4,6-trinitrotoluene (TNT) in seawater. The limit of detection of TNT is about 1 microgram per mL of untreated seawater. Carbon nanotubes (CNTs) are used to modify the electrodes using adsorptive stripping voltammetry (AdSV) for the detection of TNT. The systems that utilise carbon nanoparticles in explosive trace detectors have good sensitivity and they help produce linear responses for various concentrations of TNT. Thus, ultra-trace concentrations of TNT can be detected in seawater by using carbon nanomaterial-based sensors.

Keywords: nitroaromatic explosive, nanosensors, nanomaterials, carbon nanotubes, graphene

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