PROTECTION - SCIENCE AND TECHNOLOGY ADVANCES FOR CHEMICAL AND BIOLOGICAL PROTECTION

Ultrasensitive Chemical Nerve Agent Sensors

Seon Joo Park Korea Research Institute of Bioscience and Biotechnology (KRIBB) **Oh Seok Kwon** KRIBB

Chemical weapons were designed to kill large numbers of people in warfare, Unfortunately, they have been often used to terrorize people even in peace, not only in war. Especially, nerve gas agents such as sarin, VX, soman, and tabun are of great concern due to their odorless and colorless characteristics. Thus, intensive research has been carried out to develop sensitive, selective, and portable gas sensors. In this research, we designed novel multidimensional conducting polymer nanofibers (MCPNs) as nerve gas agenst detectors and demonstrated flexbile nerve agent sensors, as a chemiresistors, based on MCPNs. The MCPNs were firstly introduced by vapor deposition polymerization (VDP) methods on the electrospun nanofibers and the surface-to-volume ratios (62 m2 g−1) of MCPNs were maximized by controlling temperature and amount of the monomer. The mazimized MCPNs were integrated into the flexible sensor matrix (custom-made) and exposured to the various nerve gas simulants (DMMP, TCP, MDCP, TMP). The flexible chemiresistors showed ultrasensitive and selective nerve gas simulant dimethyl methylphosphonate (DMMP) compared to conventional nerve gas agent sensors. The limit-of-detection (LOD) was as low as 10 ppt, which is 2-3 orders of magnitude more sensitive than previously reported DMMP sensors. The flexible chemiresistors had excellent mechanical bendability and durability. To the best of our knowledge, this is the first example of a high- performance flexible chemical nerve agent sensor based on MCPNs.

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