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Amperometric Sensor Consisting of Gold-Nanoparticle-Dispersed Carbon Fiber Electrodes for Blister Agent Detection

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An amperometric sensor consisting of gold (Au)-nanoparticle-dispersed carbon fiber (Au-NDCF) electrodes was developed for detecting a blister agent, i.e., sulfur mustard (HD) gas. A Au-NDCF electrode was prepared by casting hexane solution containing gold nanoparticles onto a carbon fiber substrate. Field-emission scanning electron microscopy (FE-SEM) images showed that the Au particles were highly dispersed on the carbon fiber substrate. The diameter of the Au particles varied between 2 and 10 nm. By using the Au-NDCF electrode, no significant response was observed even with the introduction of atmospheric species, such as NO, NO_2, SO_2, O_3, NH_3 and CO, into the environment. The Au-NDCF electrode exhibited a relatively high sensitivity to HD, and the signal-to-noise (S/N) ratio of the proposed sensor depended on the amount of Au nanoparticles on the carbon fiber and the potential applied to the Au-NDCF electrode. Thus, the resulting electrode could be used for HD (1–20 mg/m^3) detection without the error caused by atmospheric interferences. An HD detection limit (S/N = 3) of 1.5 mg/m^3 was obtained, which is the required concentration for an on-site HD monitoring system.

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