Laboratory Analysis and on-Site Detection Method for Chemical Warfare Agents

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Chemical warfare agents (CWAs) are fast-acting and sometimes lethal, even at low levels, and can be classified into nerve gases (e.g. sarin), blister agents (e.g. mustard gas), choking agents (e.g. phosgene), blood agents (e.g. hydrogen cyanide), vomit agents (e.g. diphenylcyanoarsine) and tear gases (e.g. 2-chloroacetophenone). In the countermeasure against CWA terrorism, detection and identification are important. In crisis management before terrorism occurrence, monitoring of CWAs in public places, security checks at territorial borders, airports, big event venues, and executive facilities are performed for protection against terrorism. With regard to consequence management, on-site detection is performed by first-responders for personal protection; on-site samples are then transported to laboratories for analysis from the perspective of both investigation and emergency lifesaving. In incident management, laboratory analysis is performed to provide evidence for court in order to prevent future crimes. In the laboratory analysis, the on-site and casualty samples are subject to pretreatment and instrumental analysis is done for rapid detection and accurate identification of causative toxic substances. CWAs are easily degraded, and it is difficult to detect CWA themselves. Instead, it is efficient to detect their metabolites and degradation products. Specialist toxicological analysis technology developed in the hygiene chemistry region should contribute to terrorism countermeasure as sensitive detection and identification methods for CWAs and confirmation method for verifying CWA exposure by detecting CWA adducts in biological samples. On the other hands, sensing technology developed in the analytical chemistry region should contribute to that as on-site methods for detection CWA rapidly and autonomously.