PROTECTION - SCIENCE AND TECHNOLOGY ADVANCES FOR CHEMICAL AND BIOLOGICAL PROTECTION

Graphene Oxide/polymer Hybrid Membrane Based On Hydrogen Bonding And Size Sieving Effect For Chemical Warfare Agent Blocking.

Jiwoong Heo Agency for Defense Development **Hyunsook Jung** Agency for Defense Development **Kyeong Min Cho** Agency for Defense Development **Seung Jung Yu** Agency for Defense Development **Heesoo Jung** Agency for Defense Development

Chemical warfare agents (CWAs) are toxic materials that cause fatal damage by contact with the skin or by respiration. Research on the detoxification of CWAs has been conducted, but blocking the permeation of CWAs by the membrane is still challenging. In this work, for blocking CWAs, a multilayer thin film that consists of graphene oxide (GO) and linear polyethylenimine (LPEI) is simply fabricated through a spray-assisted Layer-by-layer (LbL) assembly process. The chain of LPEI can be changed from linear shape to coiled shape, depending on the pH condition. By tuning the morphology of the LPEI polymer chain, the GO/LPEI composite film could have a loose or dense inner structure. CWAs have hydrogen bonding sites and penetrate the membrane through diffusion. The hydrogen bonds and controlled inner structure of the membrane could effectively block the permeation of CWAs.

The protective effect of the membrane was investigated using dimethylmethylphosphonate (DMMP), which is a simulant of a nerve agent. The GO/LPEI membrane represented high protection efficiency with good breathability. DMMP vapor transmittance rate (DVTR) and N2 permeance of GO/LPEI are 67.91 g/m2 and 34,293.04 GPU. The simple preparation method with efficient protection performance has a high potential for application to protective barrier suits.