PHOTOCATALYTIC TECHNOLOGIES FOR NEUTRALIZING HAZARDOUS CHEMICAL SUBSTANCES IN THE MILITARY SPHERE

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Contamination with chemical substances is currently considered one of the main environmental problems. In Ukraine, a significant amount of various industrial facilities annually emit over 9.6 million tons of harmful substances into the atmosphere. The majority of emissions of pollutants into the atmosphere from stationary sources are contributed by energy and metallurgical enterprises.

At present, the filters-absorbers on armored vehicles, including the Ukrainian main battle tank T-64 and its modifications, as well as stationary installations created during the Soviet Union era, do not fully protect personnel from hazardous chemical substances (hereinafter referred to as HCS).

Among the non-reagent air purification methods, photocatalytic gas purification is considered optimal. Oxide composites based on titanium alloys are used as photocatalysts, capable of effectively neutralizing (decomposing) toxins of various origins under high performance conditions over a wide range of temperatures. They can even break down substances that penetrate through activated carbon-based filters. This oxidation process can convert organic compounds of various compositions into CO_2 and H_2O, enabling deep oxidation (disintegration) of organic toxicants under mild conditions. The simplicity of the devices themselves suggests prospects for practical photocatalysis utilization. Thus, for the neutralization of HCS in the future, the installation of titanium grids with oxide systems in filter-absorbers of armored vehicles and stationary objects can be considered.

It is also urgently necessary to determine the requirements for the type of ultraviolet source that will provide continuous radiation under vibration, various accelerations, and impacts, optimize the placement of the ultraviolet radiation source to reduce the size and number of "dead zones" where radiation does not reach, and determine the irradiation power that will ensure energy-efficient disintegration of toxicants depending on their composition and content in air mixtures.

References:

1. Галак О.В., Сахненко М.Д., Каракуркчі Г.В., Матикін О.В., Белоусов І.О., Косарев О.В. Методи очищення газових викидів від небезпечних хімічних речовин для підвищення ефективності фільтрувальних систем // Вісник НТУ «ХПІ». 2018. № 18 (1294). – С. 89-93.

2. Галак О.В., Сахненко М.Д., Ведь М.В., Меньшов С.М., Касьян С.В. Перспективи використання ультрафіолетових світлодіодів для нейтралізації небезпечних хімічних речовин // Збірник наукових праць ХНУПС. 2019. № 1(59). С. 111-117.

3. Дженюк А.В., Сахненко М.Д., Каракуркчі Г.В., Галак О.В., Індиков С.М., Яр-Мухамедова Г.Ш. Фізико-хімічне підгрунтя інноваційних технологій в царині фотокаталізу // Вісник НТУ «ХПІ». Серія Хімія, хімічна технологія та екологія, 2022, № 1 (7), С. 33-40.