Destruction of chemical warfare agents using metal–organic frameworks.

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Streszczenie

Chemical warfare agents containing phosphonate ester bonds are among the most toxic chemicals known to mankind1. Recent global military events, such as the conflict and disarmament in Syria2, have brought into focus the need to find effective strategies for the rapid destruction of these banned chemicals. Solutions are needed for immediate personal protection (for example, the filtration and catalytic destruction of airborne versions of agents), bulk destruction of chemical weapon stockpiles, protection (via coating) of clothing, equipment and buildings, and containment of agent spills3. Solid heterogeneous materials such as modified activated carbon or metal oxides exhibit many desirable characteristics for the destruction of chemical warfare agents4, 5, 6. However, low sorptive capacities, low effective active site loadings, deactivation of the active site, slow degradation kinetics, and/or a lack of tailorability offer significant room for improvement in these materials. Here, we report a carefully chosen metal–organic framework (MOF) material featuring high porosity and exceptional chemical stability that is extraordinarily effective for the degradation of nerve agents and their simulants. Experimental and computational evidence points to Lewis-acidic ZrIV ions as the active sites and to their superb accessibility as a defining element of their efficacy.

Słowa kluczowe

metal organic frameworks

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