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Fe-TAML® Activators Developed at Carnegie Mellon Decontaminate Anthrax Simulant

NEW YORK—Carnegie Mellon University scientists today announced that one of their powerful, environmentally friendly catalysts called Fe-TAML® activators has the potential to become an important cleanup tool for anthrax contamination.

The Fe-TAML activator used with hydrogen peroxide can substantially decontaminate a cultured, benign simulant of anthrax, they said. This anthrax simulant is commonly used in the laboratory testing of agents designed to eliminate its more deadly cousin, which is considered a significant biological warfare and terrorist threat.

The results of initial laboratory investigations are being presented by Carnegie Mellon graduate student Deboshri Banerjee on Wednesday, Sept. 10, in New York City at the 226th annual meeting of the American Chemical Society (paper 158, "Deactivation of bacterial spores using TAML®-peroxide technology towards developing an efficient process for water disinfection," Industrial & Engineering Chemistry Division). The National Science Foundation funded this research.

"In our laboratory tests, Fe-TAMLs are highly promising in cleaning up an anthrax simulant, *Bacillus atrophaeus*," said Terry Collins, the Thomas Lord Professor of Chemistry at Carnegie Mellon and the chief researcher on the Fe-TAML project. "These results indicate the enormous potential of Fe-TAMLs to kill the lethal strain of anthrax and to eradicate other water-borne infectious microbes that account for significant death and disability worldwide."

A common simulant for anthrax testing, *Bacillus atrophaeus* is a species of spore closely related to *Bacillus anthracis*, the spore that causes debilitating, often fatal anthrax. According to the Centers for Disease Control (CDC), anthrax is an agent with recognized bioterrorism potential. The CDC classifies it as a Category A agent, meaning that it poses the greatest possible threat to public health, that it may spread across a large area quickly and that its prevention requires a great deal of planning.

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Fe-TAMLs (TAML stands for tetra-amido macrocyclic ligand), synthetic catalysts made with elements found in nature, are thought to burn through the outer protein coats of the anthrax simulant spores to kill them, according to Collins. In their laboratory tests, the Collins team effectively killed 99.999 percent of cultured spores of the anthrax simulant. An even greater percent kill should be achieved, noted Collins, when the Fe-TAML technology is optimized further or combined with other technologies under development. These results are extremely encouraging, according to Collins.

The Fe-TAML-hydrogen peroxide technology should be optimal to use in the field because the components are straightforward to manufacture, are only required in small concentrations and are environmentally friendly. The two developed oxidation-based technologies currently in use clean surface-borne but not water-borne anthrax. The Fe-TAML technology, which currently targets water-borne anthrax, could be used in solution to remove anthrax spores from water supplies. In the future, this technology could possibly be used to clean surfaces contaminated with anthrax.

Potential military uses of Fe-TAML activators and hydrogen peroxide could extend beyond killing deadly biological agents, according to Collins, whose team has found that these catalysts also appear to be effective against some chemical warfare agents.

Fe-TAMLs have far-reaching promise beyond their military use, according to Collins. He expects that TAML technology could be employed broadly to eliminate deadly waterborne scourges such as those caused by *Cryptosporidium* or *Giardia*, which pose a constant threat to populations worldwide.

"Our single biggest goal," Collins explains, "is to develop a system of catalysts that can eliminate a wide range of pathogens in water to have cleaner drinking water worldwide."

Fe-TAML activators originated at Carnegie Mellon's Institute for Green Oxidation Chemistry under the leadership of Collins, who is a strong proponent of green chemistry to create environmentally friendly, sustainable technologies. Fe-TAML activators show enormous potential to provide clean, safe alternatives to existing industrial practices. They also provide ways to remediate other pressing problems that currently lack solutions.

As part of this September's American Chemical Society meeting symposium, "Green Chemistry: Multidisciplinary Science and Engineering Applied to Global Environmental Issues," the Collins group also will present results of Fe-TAML activators' effectiveness in cleaning wastewater from textile manufacturing, reducing fuel pollutants, treating pulp and paper processing byproducts, and detoxifying pesticides. At the symposium, the Collins group also will highlight how Fe-TAML activators can work with oxygen rather than hydrogen peroxide, thereby extending tremendously the range of potential applications of these catalysts.

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Note to Reporters:

For more details about Fe-TAML activators, please visit www.chem.cmu.edu/groups/collins. A full set of press materials, including backgrounders on Fe-TAML activators and the Institute for Green Oxidation Chemistry, is available by contacting Lauren Ward (email: wardle@andrew.cmu.edu; cell phone: 412-913-0175; office phone 412-268-7761). She also can provide names and contact information for outside experts familiar with the Fe-TAML technology. Press materials will be available online to the public at 5 p.m. Sept. 10 on the Mellon College of Science Web site (http://cmu.edu/mcs).

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