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Fe-TAML[®] Activators Developed at Carnegie Mellon Assist in Cleanup of the Paper and Wood Pulp Manufacturing Process

NEW YORK— Potent, environmentally friendly catalysts called Fe-TAML[®] activators, developed by scientists at Carnegie Mellon University, can destroy colored pollutants and toxic compounds resulting from paper and wood pulp processing.

The results of extensive field trials conducted by Carnegie Mellon University, Forest Research of New Zealand and the University of Auckland are being presented by Dr. L. James Wright of the University of Auckland on Wed., Sept. 10, in New York City at the 226th annual meeting of the American Chemical Society (paper 177, “Activation of hydrogen peroxide with a TAML[®] catalyst for wastewater remediation in the pulp and paper industry,” Industrial & Engineering Chemistry Division).

“Right now, we can use Fe-TAMLs with hydrogen peroxide to clean up the unsightly color from chlorine-based bleaching processes used by mills to make paper and the chlorinated byproducts of those processes, which are considered a potential health hazard,” said Terry Collins, the Thomas Lord Professor of Chemistry at Carnegie Mellon and the chief researcher on the Fe-TAML project. Collins describes the results of the decolorization as going from ‘coffee’ to ‘lemonade.’

Fe-TAMLs (TAML stands for tetra-amido macrocyclic ligand) are synthetic catalysts made with elements found in nature.

While the current study shows that the Fe-TAML activators are extremely promising in cleanup efforts, their real promise may be in replacing altogether chlorine-based bleaching processes currently in place. If accomplished, this substitution would virtually avert the formation of chlorinated byproducts altogether and greatly reduce or eliminate color production associated with paper processing, according to Collins.

The paper and wood pulp manufacturing process produces approximately 100 million tons of bleached pulp each year for use in the manufacture of a variety of cellulose-based products including white paper. In standard mill paper processing, a dark, coffee-colored effluent is produced, called ‘color’ in the industry because of its dark hue, which enters streams and rivers. This effluent often contains a

dark-colored oxidized form of a polymer derived from lignin, which is a polymer surrounding the cellulose in wood, as well as chlorinated byproducts. The effluent inhibits light from penetrating the water. Reduced light, in turn, can reduce plant growth and affect organisms that depend on those plants for food.

While Fe-TAML activators are not yet optimized to the point where they could replace chlorinated bleaching processes completely, they could be used now by paper and wood pulp mills to significantly reduce color so that brown, opaque wastewater becomes yellow and translucent, according to Collins. The decolorization process also reduces chlorinated byproducts resulting from some wood bleaching processes by nearly 30 percent.

Hydrogen peroxide catalyzed by Fe-TAML activators eventually should provide a much more efficient bleaching process than one using chlorinated compounds, according to Collins, because only small quantities of the Fe-TAML activators and hydrogen peroxide are needed to be highly effective. Furthermore, according to Collins, Fe-TAMLS are likely to be relatively inexpensive catalysts when produced in large amounts.

The field trials on color removal conducted in 2003 were funded by New Zealand resources and by the Eden Hall Foundation in Pittsburgh, Pennsylvania.

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 will present results of Fe-TAML activators' effectiveness in killing a simulant of a biological warfare agent, reducing fuel pollutants, cleaning wastewater from textile manufacturing 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.

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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