Green catalysts provide promise for cleaning toxins and pollutants

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Tetra-Amido Macrocyclic Ligands (TAMLs) are environmentally friendly catalysts with a host of applications for reducing and cleaning up pollutants, and a prime example of "green chemistry." Carnegie Mellon University's Terry Collins, the catalyst's inventor, believes that the small-molecule catalysts have the potential to be even more effective than previously proven.

Collins will discuss how iron-TAMLs (Fe-TAMLs) work and areas for further research, citing evidence from mechanistic and kinetic studies of the catalyst on Monday, Aug. 18 at the 236th national meeting of the American Chemical Society in Philadelphia.

The oxidation catalysts are the first highly effective mimics of peroxidase enzymes. When partnered with hydrogen peroxide, they are able to convert harmful pollutants into less toxic substances. Made from the common elements of biochemistry, carbon, hydrogen, nitrogen and oxygen around a reactive iron core, Fe-TAMLs are less toxic and usable at extremely low concentrations. Additionally, their composition also results in very strong chemical bonds that are not broken down by the highly reactive oxygen intermediaries formed during the reaction with hydrogen peroxide.

"Our recent studies into what occurs during the chemical reaction caused by TAMLs proves that the catalysts are indeed really close mimics of peroxidase enzymes," said Collins, the Thomas Lord Professor of Chemistry and director of the Center for Green Science at Carnegie

Mellon. "By knowing the mechanics of the reactions, we can fine tune the catalysts for even better performance."

Research by the Collins group at Carnegie Mellon has shown that Fe-TAMLs have enormous potential to provide clean and safe alternatives to existing industrial practices and provide ways to remediate other pressing environmental problems that currently lack solutions. The catalysts have proven effective in degrading estrogenic compounds, cleaning waste water from textile manufacturing, reducing fuel pollutants, treating pulp and paper processing byproducts and decontaminating a benign simulant of anthrax.

Source: Carnegie Mellon University