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# Researchers develop inexpensive hydrolysable polymer

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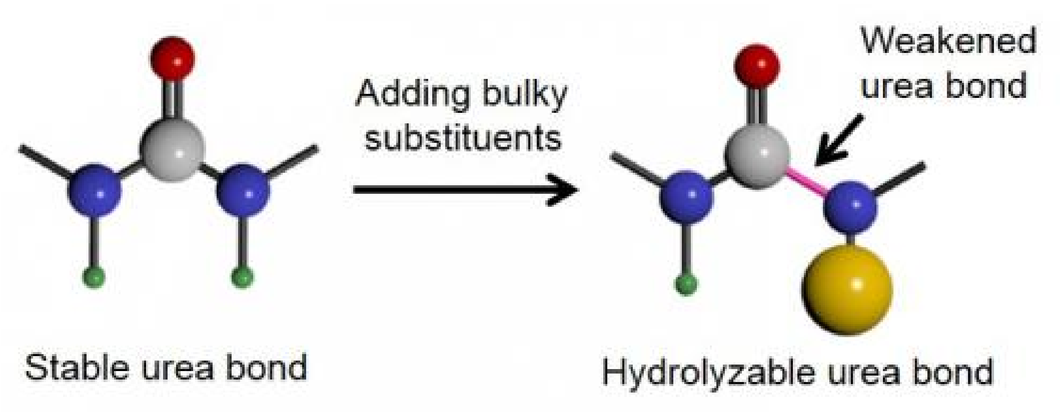


Hindered urea bond-containing polymeric materials (PHUs) are cheap polymers that can be designed to degrade over a specified time period. Credit: Catherine Yao

Researchers at the University of Illinois at Urbana-Champaign have figured out how to reverse the characteristics of a key bonding material—polyurea—providing an inexpensive alternative for a broad number of applications, such as drug delivery, tissue engineering, and packaging.

"Polymers with transient stability in aqueous solution, also known as hydrolysable polymers, have been applied in many biomedical applications, such as in the design of drug delivery systems, scaffolds for tissue regeneration, surgical sutures, and transient medical devices and implants," explained Jianjun Cheng, an associate professor of materials science and engineering at Illinois. "Polyurea materials are widely used in our daily life as coating, painting, and adhesive materials. The highly inert urea bond makes the inexpensive polymer extremely stable, a property that is suitable for some long-lasting applications."

Through some inventive chemistry, Cheng and his colleagues have developed a class of "hindered urea bond-containing polymeric materials" or "poly(hindered urea)s" (PHUs)—cheap polymers that can be designed to degrade over a specified time period, making them potentially useful in biomedical and agricultural applications.

"While conventional polyurea are very stable against hydrolysis, PHUs can be completely hydrolyzed within a few days," Cheng added. "Since 'hindrance' is the cause of the bond destabilization, the hydrolysis kinetics of PHUs can be easily tuned as needed for a specific application. They can potentially be environmentally friendly green and sustainable materials as well."

"Polyurea usually contain ester and other hydrolysable bonds, such as anhydride, acetal, ketal, or imine, in their backbone structures," said Hanze Ying, a graduate student in Cheng's research group and first author of the paper published in the *Journal of American Chemical Society*. "In this study, we demonstrated the potential of PHUs for the design of water degradable polymeric materials that can be easily synthesized by mixing multifunctional bulky amines and isocyanates, expanding the family of hydrolysable polymers."

"Hydrolysable polymers have also been applied in the design of controlled release systems in agriculture and food industries and used as degradable, environmentally friendly plastics and packaging materials," Cheng said. "These applications usually require short functioning time, complete degradation and clearance of materials after their use."

According to the researchers, the new PHUs potentially have great advantages over many other hydrolyzable polymers. PHUs can be made with inexpensive chemical precursors in ambient conditions via simple and clean chemistry with no catalyst or by-products, making it possible for end-users to control the copolymer recipe for specific use without the need of complicated synthesis apparatus.

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