Supercomputers ensure plastics peg out later

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The research team used supercomputers to understand the breakdown of plastics.

(PhysOrg.com) -- Scientists from The Australian National University have used supercomputers to reveal how plastic items like the humble clothes peg can be designed to withstand the sun for longer.

The researchers, led by Associate Professor Michelle Coote and PhD student Ms Anya Gryn'ova from the ARC Centre of Excellence for Free Radical Chemistry and Biotechnology at ANU, have used sophisticated quantum chemistry and supercomputers to model polymer degradation and discovered how to make better, more robust plastics. Their work will be published in an upcoming special edition of The Royal Society Chemistry journal, *Organic & Biomolecular Chemistry*.

“Although plastics have been manufactured for a long time, in this study we have uncovered critical information about creating longer lasting plastics which is important if we want to reduce the amount of plastic waste entering landfill every year,” said Associate Professor Coote.

Historically scientists have thought that clothes pegs and other plastics left out in the sun become brittle and fail due to a process called autoxidation. Exposure to light or heat generates free radicals, which are reactive species that attack the polymeric chains in the plastic causing them to rearrange and break. Crucially, each ‘broken’ polymer chain is then thought to attack the next polymer chain, leading to a cascading failure that results in visible damage to the plastic.

However, the research led by Associate Professor Coote suggests that most types of plastics should actually be inherently resistant to this process and the reason damage occurs at all is because most polymer chains contain a small number of defect structures, formed during their manufacture.

“The good news is that if you can remove these defect structures you could greatly improve the stability of many plastics,” said Ms Anya Gryn’ova.

The findings of this research have led to a number of recommendations to prolong the shelf-life of plastics, including using improved manufacturing reaction conditions and choosing more resistant polymers for long term plastic design. Conversely, the information gained in this study will also assist in creating improved biodegradable plastics.

“Our research has shed considerable light on the process of how plastics degrade and should mean that brittle clothes pegs falling off the line are a thing of the past,” said Associate Professor Coote.