Infrared light-responsive controlled-release pesticide helps to regulate pesticide saturation

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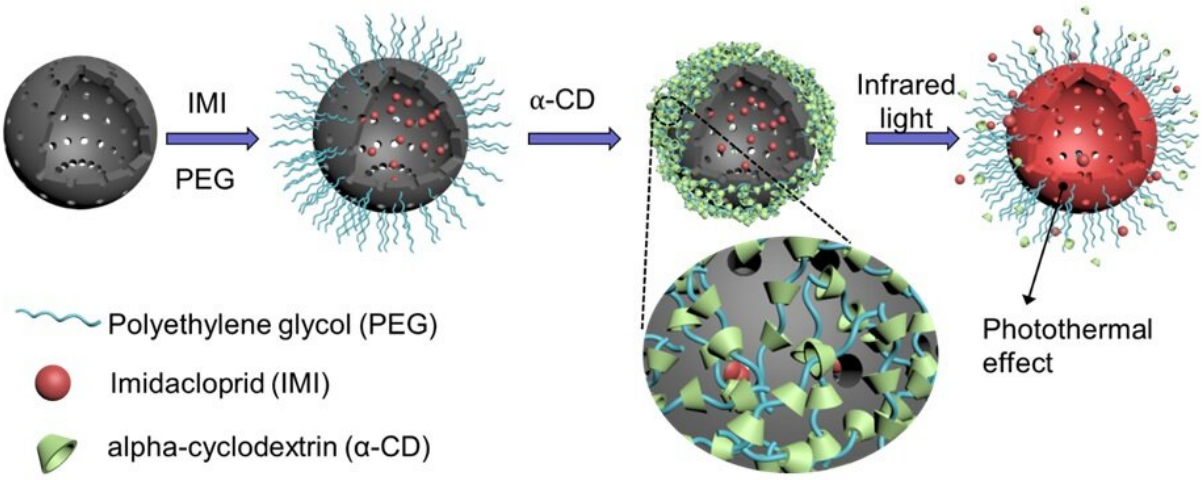

Schematic illustration of mechanism. Credit: LIU Bin

A team led by Prof. Wu Zhengyan from the Institute of Intelligent Machines of the Hefei Institutes of Physical Science developed a novel infrared light-responsive controlled-release pesticide system, named HCMs/IMI/PEG/α-CD, to regulate pesticide release and enhance pesticide efficiency. The result was published in *Agricultural and Food Chemistry*.

The use of pesticides is indispensable for agricultural production, while unfortunately, large proportions of applied pesticides fail to reach their targets, and so modern agriculture uses abundant pesticides frequently to assure crop production, resulting in severe contamination to the terrestrial and aquatic environments. It's urgent to develop new approaches to enhance utilization efficiency of pesticides.

In this research, hollow carbon microspheres (HCMs) was fabricated by using calcium carbonate ($CaCO_3$) as a template and dopamine as carbon source. HCMs were loaded with imidacloprid (IMI) and further coated by polyethylene glycol (PEG) and alpha-cyclodextrin (α-CD) successively to prepare the light-controlled pesticide release system (HCMs/IMI/PEG/α-CD).

According to the researchers, PEG chains could penetrate into α-CD cavities, giving rise to a gel network, and locking the pesticide inside. Infrared light could stimulate the pesticide carrier to generate heat because of the excellent photothermal effect of HCMs, disrupting the gel network and releasing pesticide.

This study offers a new strategy to balance the "need and supply" of pesticides and decrease undesirable release of pesticides, improve pesticide efficiency and reduce pesticide usage.

More information: Bin Liu et al, Infrared-Light-Responsive Controlled-Release Pesticide Using Hollow Carbon Microspheres@Polyethylene Glycol/α-Cyclodextrin Gel, *Journal of Agricultural and Food Chemistry* (2021). DOI: 10.1021/acs.jafc.1c01265

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