Improving the Efficacy of Pesticides

MIT's sticky agricultural spray *adheres to right side of plant leaf; traditionally applied pesticide is shown on the left.* Photo courtesy MIT.

While "sticky" can refer to a difficulty or problem, it also may be a resolution to enhancing the application of pesticides. Maher Damak, PhD, Massachusetts Institute of Technology (MIT) and his colleagues have developed an innovative sticky agricultural spray that has the potential to dramatically increase the effectiveness of pesticides on a broad range of crops.

Damak created a biodegradable additive made up of electrically charged polymers derived from brown seaweed and crustaceans such as crabs and shrimp. When the additive is mixed with existing pesticides, the resulting spray adheres to plants far better than traditionally formulated pesticides. That's because most plants are hydrophobic (water-repellant), which means that when they are sprayed with pesticides, only about 2% of the chemicals stick to the target. The other 98% rolls off, dispersing into the soil or water supply, creating an environmental contaminant and an economic burden for farmers. In fact, Damak says, more than $100 billion is spent on pesticides annually.

The negatively and positively charged polymers in the additive Damak developed interact with one another to create hydrophilic (water-attracting) spots that are 100 times thinner than a strand of hair, allowing for full coverage of a plant's surface. Currently, farmers typically rely on the addition of surfactants to pesticides in order to reduce surface tension of the sprayed fluid, but this approach is often ineffective.

"This method can theoretically work on any crop," Damak reports. "For our initial testing, we are working with citrus trees and grapevines," he continues. "We are also targeting vegetables, rice, and wheat for the next stages of testing."

Damak's ingenuity was recognized last year when he was among the recipients of a 2018 Lemelson-MIT Student Prize. The prizes are awarded annually by The Lemelson Foundation to students whose inventions provide solutions to real-world problems in a variety of different areas.

Earlier this year, MIT's Abdul Latif Jameel Water and Food Systems Lab awarded a renewal grant to the sticky pesticide project that will support further field testing and refinement of the technology for use on farms.

Sticky Proteins

According to a study published recently in *Green Chemistry*, researchers in Germany have developed functional peptides that adhere to the surface of soybean leaves and prevent the germination of *P. pachyrhizispores* spores, which can lead to soybean rust disease.

In experiments, the fused antimicrobial peptides bound strongly to the waxy surface layer of soybean, barley, and corn leaves and resisted washing away due to rainfall. On soybean leaves, the sticky proteins withstood high temperature, sunlight, and biotic degradation for at least 17 days.

The researchers "expect that bifunctional peptides or proteins consisting of an adequate plant-attaching anchor peptide (e.g., THA) and antimicrobial or pesticidal peptides, proteins, or cells can be used to fight essentially any plant pest and disease in an eco-friendly and rainfast manner." **FT**

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