

Next-Generation Insecticides Immobilized in Inert Carriers for Superior Pest and Vector Control

Technology

The Kahr Lab at NYU, in collaboration with researchers at the Weizmann Institute, have developed an innovative formulation of amorphous deltamethrin loaded into an inert silica-based carrier, such as Cabosil, that enhances its lethality for urban pest and vector control applications by improving dispersibility and stability. The innovators have previously reported the discovery of a second polymorph (Form II) of deltamethrin that was approximately 10 times more active in its amorphous form than the known commercial crystalline polymorph (Form I) at comparable loadings. As described in unpublished work, the innovators leverage the capabilities of porous carrier materials to facilitate a stable and efficient dispersion of more potent amorphous deltamethrin at lower temperatures. This is evidenced by the formulation's superior knockdown rates, achieving a 50% knockdown of fruit fly populations faster than existing commercial products like D-Fense dust. The incorporation of inert carriers not only simplifies industrial applications by permitting robust dispersion in various settings, but also stabilizes the insecticide in the amorphous state, thereby minimizing undesired crystallization, which would diminish the insecticides' efficacy over time. The strategic combination of an inert carrier with amorphous deltamethrin represents an elegant and promising advancement in the development of next-generation pest and vector management solutions.

Background

Deltamethrin, a pyrethroid insecticide, has proven essential in urban pest control and vector management, particularly in reducing diseases like malaria. Over the past fifty years, its application in products such as long-lasting insecticidal bed nets has been pivotal, yet rising resistance among mosquitoes and other insect species to synthetic pyrethroids now threatens these achievements. Deltamethrin's polymorphism—yielding both a stable form (commercially available) and a faster-acting metastable Form II—demonstrates that alterations in crystalline structure can significantly impact efficacy by enhancing liberation and uptake of the insecticide. Developing a stable amorphous version of deltamethrin immobilized in an inert carrier could optimize its activity in pest control, ensuring more effective and robust management of pest populations and disease vectors in diverse settings.

Development Stage

The Kahr Lab plans to perform quantitative studies of amorphous deltamethrin crystallization on various substrates and as a function of the dispersion amongst particles.

Applications

Technology ID

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Category

Life Sciences/Biochemicals &
Small Molecules

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- **Insecticidal dust for:**
 - Urban pest and vector control, via indoor residual spraying (IRS) applications
 - Crop and livestock protection

Advantages

- **Enhanced knockdown:** Amorphous deltamethrin exhibits faster uptake by pests via contact or ingestion.
- **Improved dispersibility:** Immobilizing deltamethrin in inert carriers permits robust deployment in diverse and/or unfavorable settings.
- **Resistance management:** Higher knockdown rates are expected to combat pyrethroid-resistant pests and vectors.
- **Higher potency:** Less deltamethrin is required to achieve desired effects.
- **Improved shelf life:** Substrate immobilization is expected to stabilize the amorphous state over long time periods.

Intellectual Property

NYU has filed a PCT application covering compositions of amorphous deltamethrin dispersed in various inert carriers, the method of using such compositions for pest and vector control, and the method of manufacturing the same.

References

1. Yang, Jingxiang et al. , <https://pubmed.ncbi.nlm.nih.gov/33046642/>
2. Carson, Jessica et al. , <https://pubmed.ncbi.nlm.nih.gov/37081532/>