DETERMINATION OF λ-CYHALOTHRIN IN CRUDE PALM OIL AND CRUDE PALM KERNEL OIL BY SOLID PHASE EXTRACTION AND GAS CHROMATOGRAPHY ELECTRON CAPTURE DETECTION

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Herbicides and insecticides are the main pesticides used in oil palm plantations. Being relatively cheap, insecticides such as λ-cyhalothrin are often used to protect the oil palm against leaf-eating insects. However, insecticides may have adverse effects on the environment and human health, and the presence of insecticide residues in food and food ingredients is of great concern. As such, reliable analytical methods for the detection and quantification of insecticide residues in palm oil and palm kernel oil are needed to safeguard public health.

SCOPE

The test method described herein is for the determination of λ-cyhalothrin in crude palm oil (CPO) and crude palm kernel oil (CPKO).

DEFINITION

The λ-cyhalothrin is the common name for (RS)-α-cyano-3 phenoxybenzyl (1RS)-*cis*,*trans*-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate ($C_{22}H_{19}Cl_2NO_3$). Halo, Mako Siloco 280 are some of the trade names for λ-cyhalothrin. In its pure form, λ-cyhalothrin is a colourless solid. Its melting point is around 49.2°C. The λ-cyhalothrin has low solubility in water (0.005 mg litre^{-1}) and its molecular weight is 449.9 (Kidd and James, 1991). *Figure 1* shows the chemical structure of λ-cyhalothrin.

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Principle

The λ-cyhalothrin is extracted from oil matrices using acetonitrile. The extract is then subjected to low temperature precipitation where the analyte partitions into the polar acetonitrile layer, and the bulk of the frozen oil phase can then be filtered off. The acetonitrile filtrate is then cleaned up by passing it through a solid phase extraction (SPE) cartridge (*Figure 2*). The detection and quantification of λ-cyhalothrin is by gas chromatography using an electron capture detector (GC-ECD) (*Figure 3*).

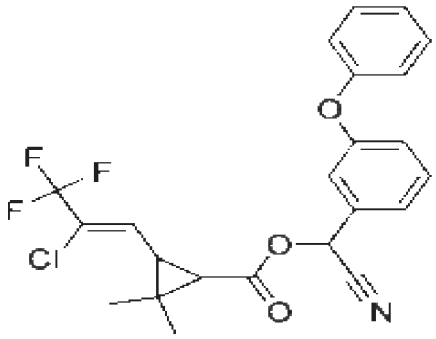

Figure 1. Chemical structure of λ-cyhalothrin.

Figure 2. Solid phase extraction manifold.

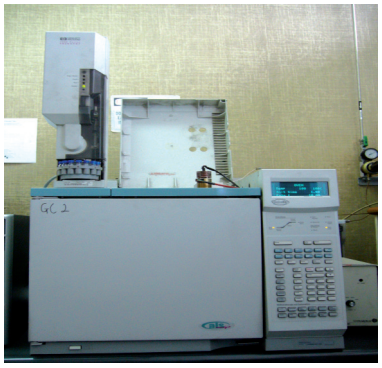

Figure 3. GC-ECD for λ-cyhalothrin analysis.

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Recovery Studies

Recoveries of λ-cyhalothrin from CPO samples spiked with 0.05-1.0 mg kg^{-1} λ-cyhalothrin standards range from 82%-97% with coefficients of variation between 4% and 8%. *Figure 4* shows the GC-ECD chromatograms of (A) standard λ-cyhalothrin at 0.1 $\mu g\ ml^{-1}$, (B) blank CPO, and (C) CPO spiked with 0.1 $\mu g\ ml^{-1}$ λ-cyhalothrin standard.

For the extraction of λ-cyhalothrin from CPKO samples spiked with 0.05- 1.0 $\mu g\ g^{-1}$ of λ-cyhalothrin standard, the recoveries were between 86% and 94% with coefficients of variation ranging from 5%-10%.

The limit of detection of λ-cyhalothrin in both CPO and CPKO is 0.01 $\mu g\ ml^{-1}$. *Figure 5* shows the GC-ECD chromatograms of (A) standard λ-cyhalothrin at 0.1 $\mu g\ ml^{-1}$, B) blank CPKO, and (C) CPKO spiked with 0.1 $\mu g\ ml^{-1}$ λ-cyhalothrin.

SERVICES AVAILABLE

Services on offer include:

- quantification of λ-cyhalothrin in CPO and CPKO; and
- private laboratories are encouraged to adopt this method as part of their scope of analyses. The cost of method transfer including competency training for the analyst is negotiable.

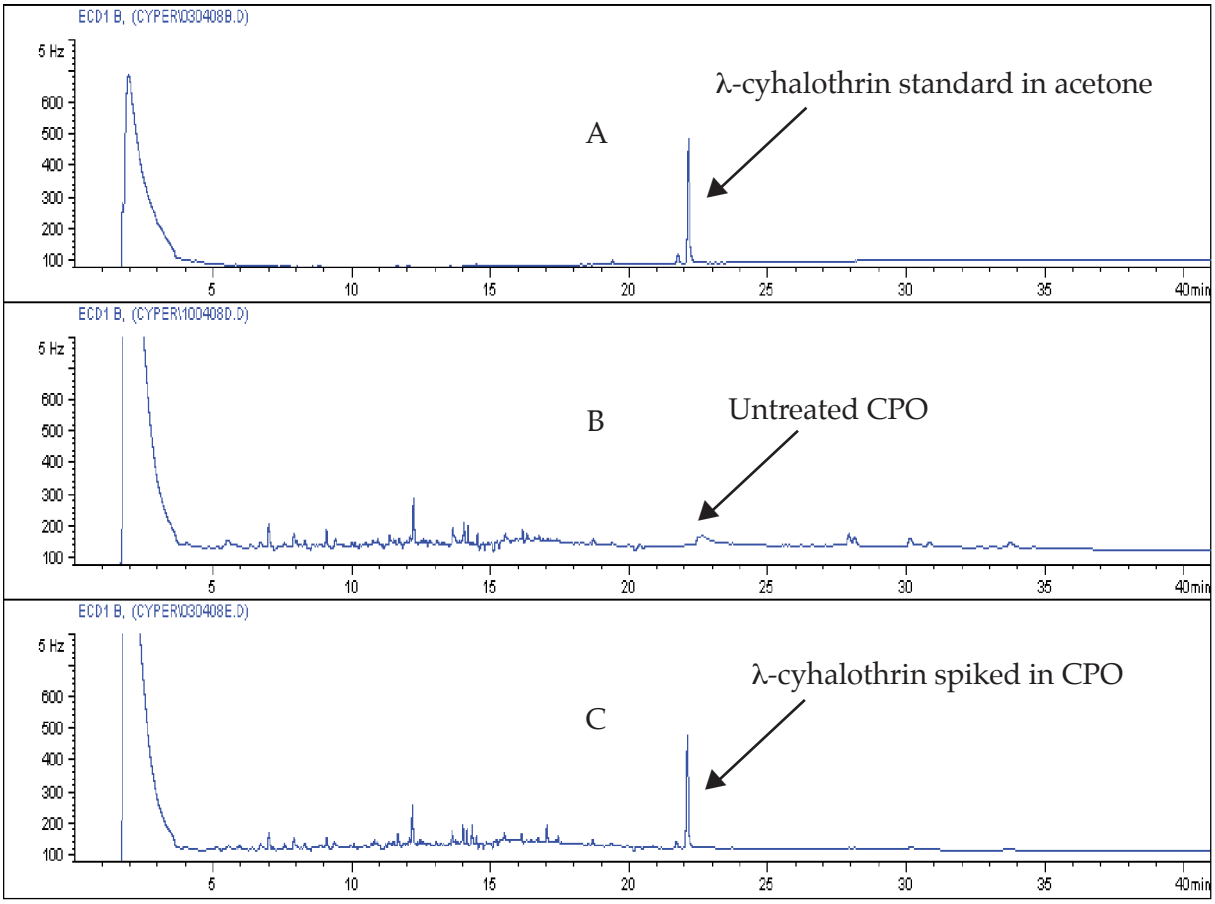

Figure 4. GC-ECD chromatograms of (A) standard λ-cyhalothrin at 0.1 $\mu g\ ml^{-1}$, (B) untreated crude palm oil (CPO) and (C) CPO spiked with 0.1 $\mu g\ ml^{-1}$ λ-cyhalothrin.

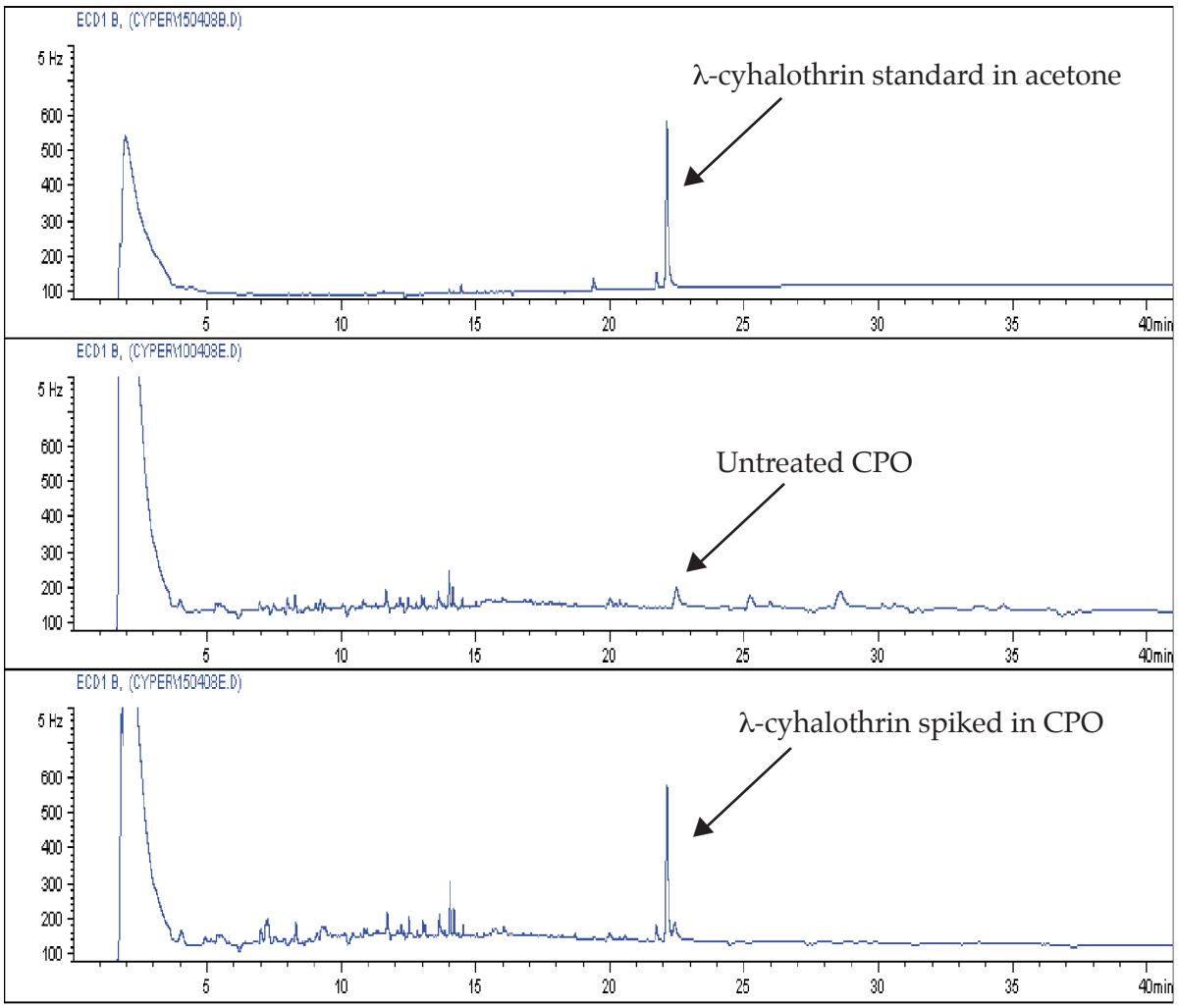

Figure 5. GC-ECD chromatograms of (A) standard λ-cyhalothrin at 0.1 µg ml^{-1}, (B) blank crude palm kernel oil (CPKO) and (C) CPKO spiked with 0.1 µg ml^{-1} λ-cyhalothrin.

CONCLUSION

The λ-cyhalothrin is used in oil palm plantations to control leaf-eating pests such as bagworms, nettle caterpillars and rhinoceros beetles. Therefore, it is important that the palm oil industry has a reference method for determining λ-cyhalothrin residues in CPO and CPKO.

REFERENCE

KIDD, H and JAMES, D R (1991). *The Agrochemicals Handbook.* Third edition. Unwin Brothers Limited, Old Woking, Surrey.

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