

Herbicides and insecticides are the main pesticides used in oil palm plantations. Being relatively cheap, herbicides such as diuron are often used to control broad-leaf weeds in oil palm plantations. However, the use of herbicides is always associated with the risk of food contamination. In order to monitor and minimize the risk of pesticide residues in food, it is necessary to develop reliable analytical methods for the detection and quantification of herbicide residues in palm oil and palm kernel oil.

SCOPE

The test method prescribes the requirements for the determination of diuron in crude palm oil (CPO) and crude palm kernel oil (CPKO).

DEFINITION

Diuron is the common name for 3-(3,4-dichlorophenyl)-1,1-dimethyl urea ($C_9H_{10}Cl_2N_2O$). Some of its trade names include *Karmex*, *Crisuron*, *Di-on*, *Diater*, *Diurex*, *Toterbane* and *Unidron*. In the pure form, it is an odourless crystal while a sample of 93% purity is a viscous semi-solid. Its melting point is in the range of 158°C-159°C. Diuron has low solubility in water (42 mg litre⁻¹) and its molecular weight is 233.1 (Kidd and James, 1991). *Figure 1* shows the chemical structure of diuron.

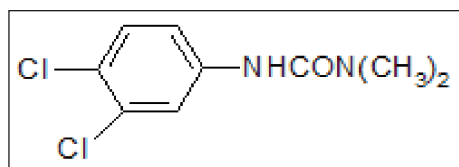


Figure 1. Chemical structure of diuron.

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DETERMINATION OF DIURON IN CRUDE PALM OIL AND CRUDE PALM KERNEL OIL

Principle

This method involves the extraction of diuron from the oil matrix using acetonitrile. The extract is then subjected to low temperature precipitation before clean-up using solid phase extraction (SPE) (*Figure 2*) with acetonitrile as the eluting solvent. The detection and quantification of diuron is by high pressure liquid chromatography using an ultra violet detector (HPLC-UV) (*Figure 3*).

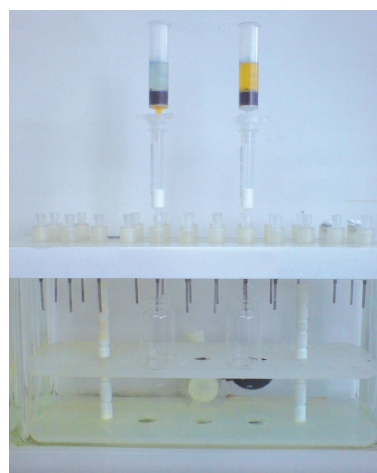


Figure 2. Solid phase extraction.



Figure 3. High performance liquid chromatography – ultra violet (HPLC-UV).

RECOVERY STUDIES

Recoveries of diuron from CPO samples spiked with 0.1-1 mg kg⁻¹ standard diuron ranged from 83%-101% with coefficients of variation between 1% and 9%. Figure 4 shows the HPLC-UV chromatograms of (A) standard diuron 1.0 µg ml⁻¹, (B) blank CPO and (C) CPO spiked with 1.0 µg ml⁻¹ diuron standard.

For the extraction of diuron from CPKO, the recoveries were between 79% and 88% with coefficients of variation ranging from 0.9%-6%. Figure 5 shows the HPLC-UV chromatograms of

(A) standard diuron, 1.0 µg ml⁻¹, (B) blank CPKO and (C) CPKO spiked with 1.0 µg ml⁻¹ diuron. The limit of detection of diuron in both CPO and CPKO is 0.01 µg ml⁻¹.

SERVICES AVAILABLE

- Quantification of diuron in CPO and CPKO.
- Private laboratories are encouraged to adopt this method as part of their scope of analyses. The cost of method transfer including competency training for analyst is negotiable.

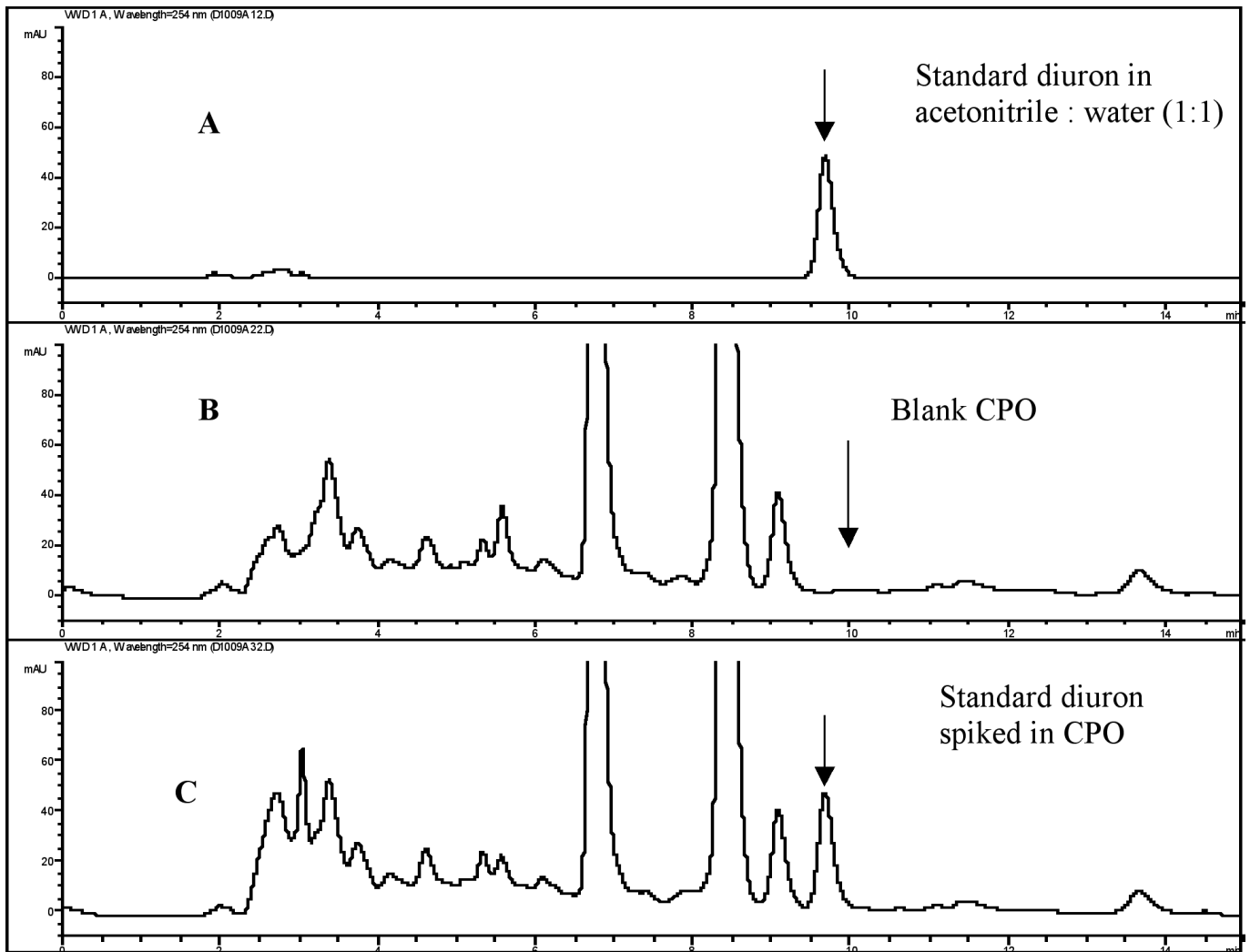


Figure 4. HPLC-UV chromatograms of (A) standard diuron 1.0 µg ml⁻¹, (B) blank crude palm oil and (C) CPO spiked to 1.0 µg ml⁻¹ diuron.

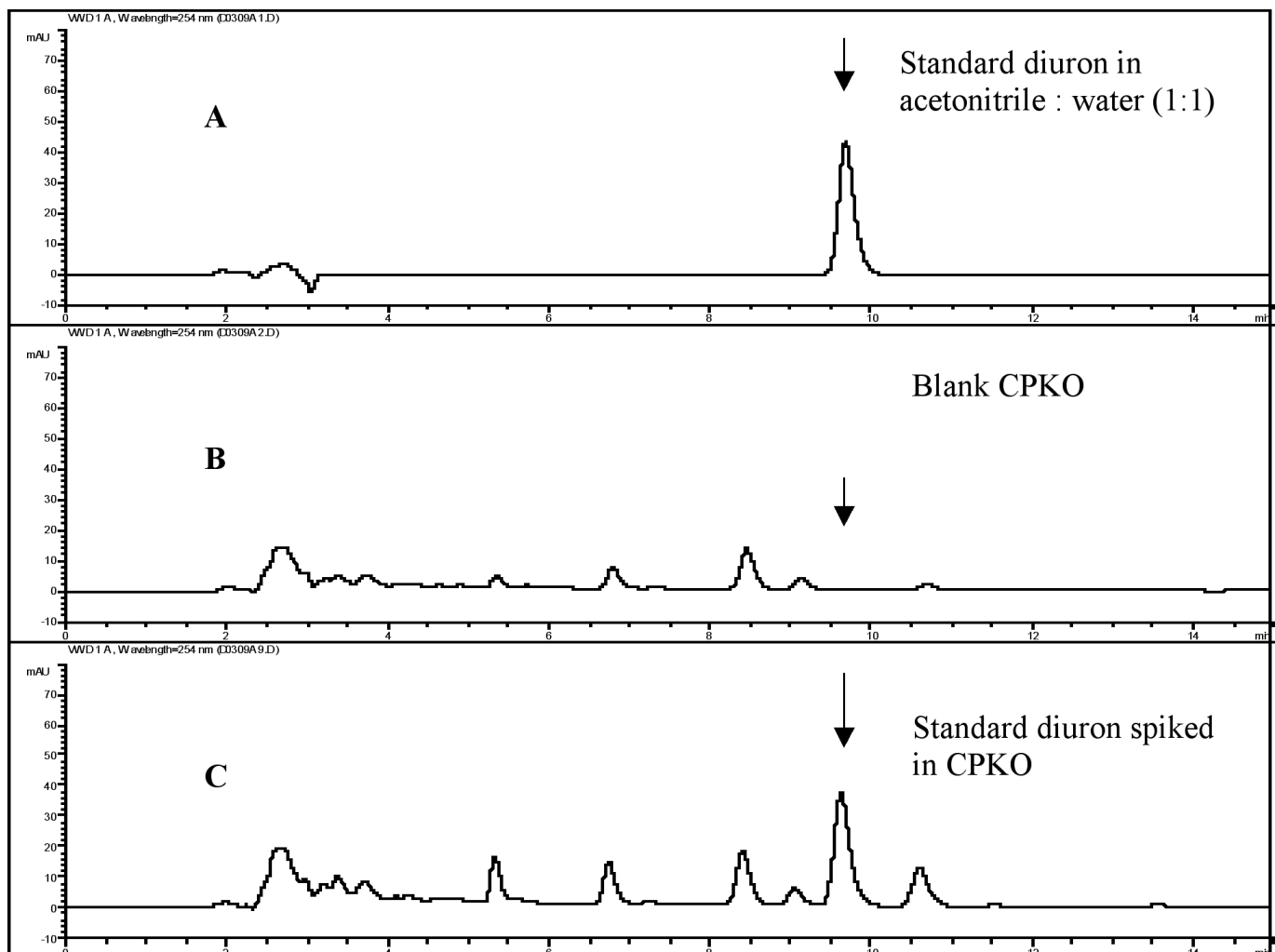


Figure 5. HPLC-UV chromatograms of (A) standard diuron $1.0 \mu\text{g ml}^{-1}$, (B) blank crude palm kernel oil and (C) CPKO spiked to $1.0 \mu\text{g ml}^{-1}$ diuron.

CONCLUSION

Pesticides used in oil palm plantations are mainly the herbicides. Diuron is used for the control of most broad-leaved weeds in agricultural crops. It is absorbed principally through the roots and is a broad-spectrum herbicide. Therefore, it is important that the palm oil industry has a reference method for the determination of diuron residue in CPO and CPKO.

REFERENCE

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

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