

Pesticide Analysis in Soil

At present, there are many kinds of pesticides used in agricultural production. The chemical structure and properties of these pesticides are different, the range of concentration fluctuation is large, the composition of soil matrix is extremely complex, and there are many kinds of disturbing impurities. Detection of pesticide residues in soil belongs to trace (mg kg⁻¹), or even ultra-trace (ug kg⁻¹) range of analysis, which requires a more effective detection technology of pesticide residues. With the development of science and technology, there are many new pesticide varieties with low dosage and residue. Meanwhile, the pesticide residue limit requirements are getting lower and lower, which put forward higher requirements for pesticide residue detection technology.

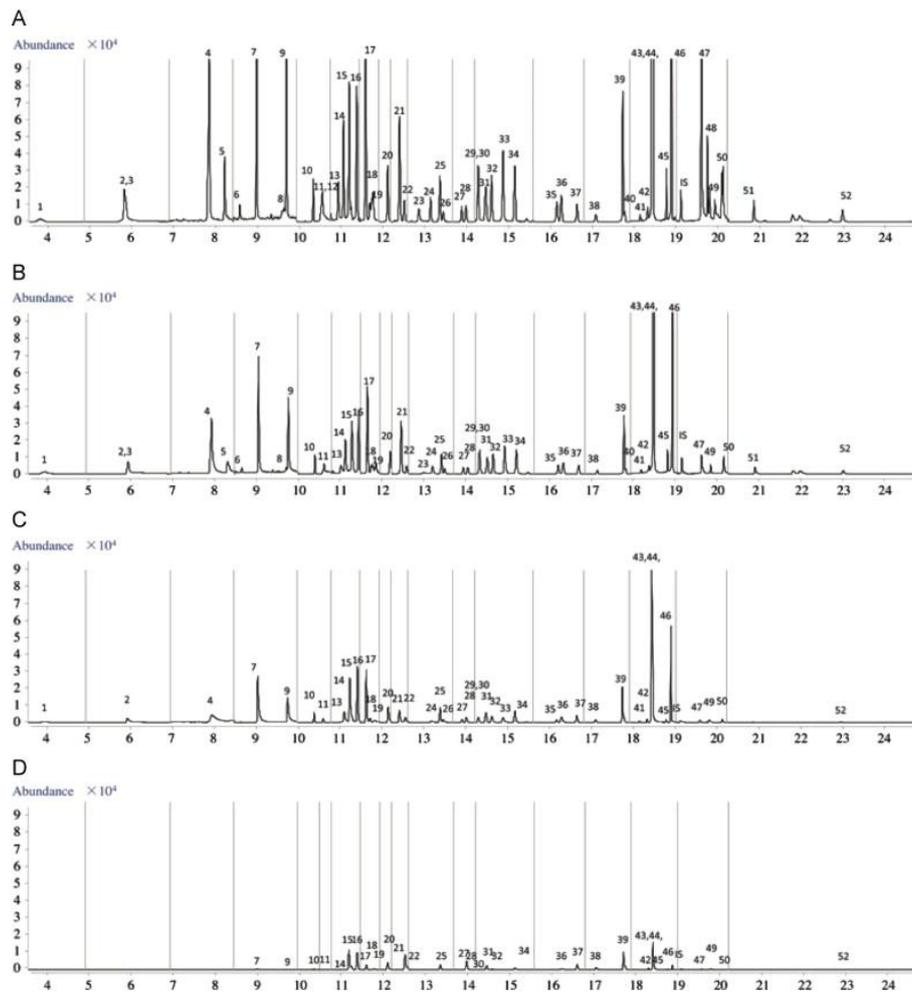


Fig 1. The typical total ion chromatograms of 52 pesticide residues were acquired by multiple reactions monitoring mode. Spiked samples were performed by different methods, including SPLE (A), PLE-GPC (B), SPE (C), and SPME (D).³

Pretreatment

Soil sample pretreatment technology mainly includes extraction, purification, concentration and other technologies, the three usually have no strict boundaries. In pesticide residue analysis, sample pretreatment is the basis of pesticide residue detection, it is the key step, directly related to the accuracy and precision of the whole pesticide residue analysis process. Sample pretreatment needs to extract the components from the sample to the maximum extent, to eliminate the interfering substances to the greatest extent, to reduce the experimental error, and to avoid contamination of the detection instrument. At the same time, due to the variety of samples, different samples need different pretreatment methods, so sample pretreatment technology is still the difficulty of pesticide residue detection technology at home and abroad.

With the development of technology, sample separation and extraction technology has been developed rapidly. Some advanced sample pretreatment technologies have been applied to the field of pesticide residue analysis. These new technologies have the advantages of high efficiency, fast, time-saving, labor-saving, less environmental pollution, safety, easy miniaturization and automation. At present, the sample pretreatment techniques reported or widely used in the world are solid phase extraction, ultrasonic extraction, solid phase microextraction, microwave extraction, matrix dispersive solid phase extraction, accelerated solvent extraction, supercritical fluid extraction, gel permeation chromatography, etc.

Martínezdomínguez used different pretreatment methods to pre-treat the samples containing pesticide residues. It can be seen in the figure 1 that different pretreatment methods have different effects on the results.

Pesticide residue analysis

Chromatography is the most classical and commonly used technology in modern pesticide residue detection, and is also the main method used in soil residue detection. It is based on the distribution coefficient of the target substances on the chromatographic column to separate, through different detectors to detect

compounds, according to retention time and peak area and other pairs of combination. GC and HPLC are now in widely used in separation and detection.

At the same time, mass spectrometry (MS) is an important method for qualitative identification and structural analysis. MS overcomes the shortcomings of overlapping impurity peaks and retention time of pesticides. Moreover, the selective ion detection technology can be used to detect only the characteristic ions of pesticides, which can eliminate a large number of interfering substances in the samples and improve the sensitivity and accuracy of pesticide detection. To combine the edge of MS and chromatography, LC-MS is widely used for effective separation and detection of pesticide residue analysis.

References

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