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Analysis of Malathion in Human Blood Utilizing Solid-Phase Extraction (SPE) Coupled with Gas Chromatography-Mass Spectrometry (GC-MS)

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Structured Abstract

Background: Malathion, a widely used organophosphorus pesticide in agriculture, can be detected and quantified in blood samples, which is crucial for investigating suspected poisoning, accidental exposure, or intentional harm cases. With an LD50 classified as dangerous, researchers have been investigating its impact to minimize usage and raise awareness. Various extraction methods, such as liquid-liquid extraction (LLE), have been used, but they can be time-consuming and require large amounts of samples and solvents, resulting in high costs.

Methods: Hence, this research aims to develop a method to extract and analyse malathion from human blood using solid-phase extraction (SPE) coupled with gas chromatography-mass spectrometry (GC-MS). The method helps determine the concentration of malathion in blood samples and investigates whether optimization significantly improves the efficiency of malathion extraction.

Results: This study developed a method using a C18 cartridge for the sorbent in SPE, utilizing 4 steps namely conditioning, sample loading, washing, and elution with a non-polar solvent. The method successfully extracted malathion at 7.336 min based on the GC-MS library. Optimizations that have been observed include the type of cartridges, the type of elution solvent, and the sample volume. For instance, C18 cartridges provided a relative standard deviation (RSD) value of 61.62%. Using chloroform: isopropanol in a 9:1 ratio as the elution solvent resulted in an average percentage recovery of 10.24%. Additionally, varying the sample volume showed an increase in the average percentage recovery, with the highest recovery observed at 6 mL, yielding a value of 24.12% with 96.88 ppm.

Conclusion: In conclusion, the findings indicate that as the sample volume increases, the average percentage recovery also increases. While this method successfully extracts malathion from human blood samples, improvements can be made to ensure higher recovery percentages and lower RSD values, such as using a more non-polar eluent solvent to increase analyte recovery as well as maintaining a consistent room temperature (20 °C to 24 °C) during the extraction process in which could prevent the degradation of malathion, leading to higher recovery rates.

Keywords: Malathion, Human Blood, SPE, GC-MS

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