

Pesticides Analysis in Complex Matrices using ASAP-MS

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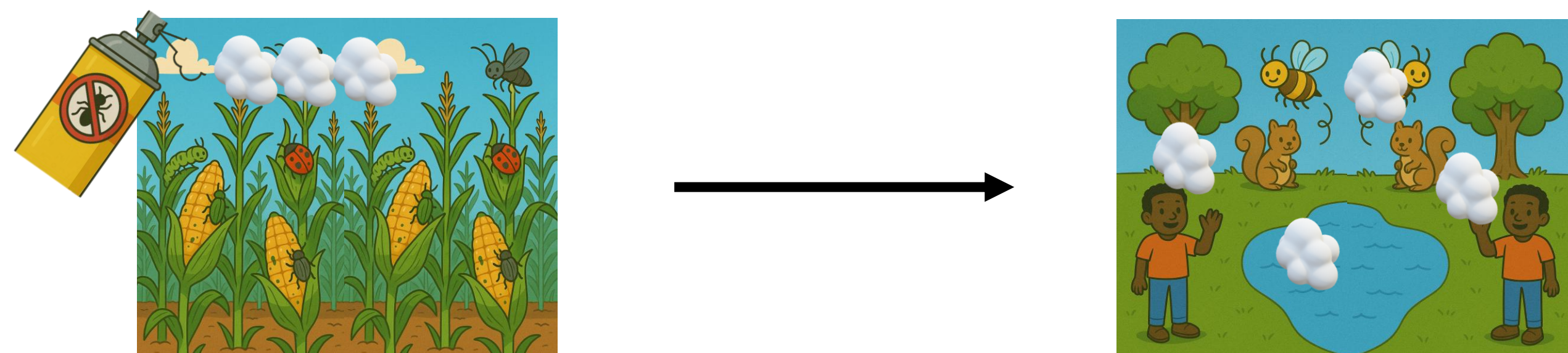
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1: Introduction

Figure 1a: Pesticides Introduced into the Environment



Testing Options to monitor and detect pesticide levels

Current Methods:
Chromatography and Immunoassays

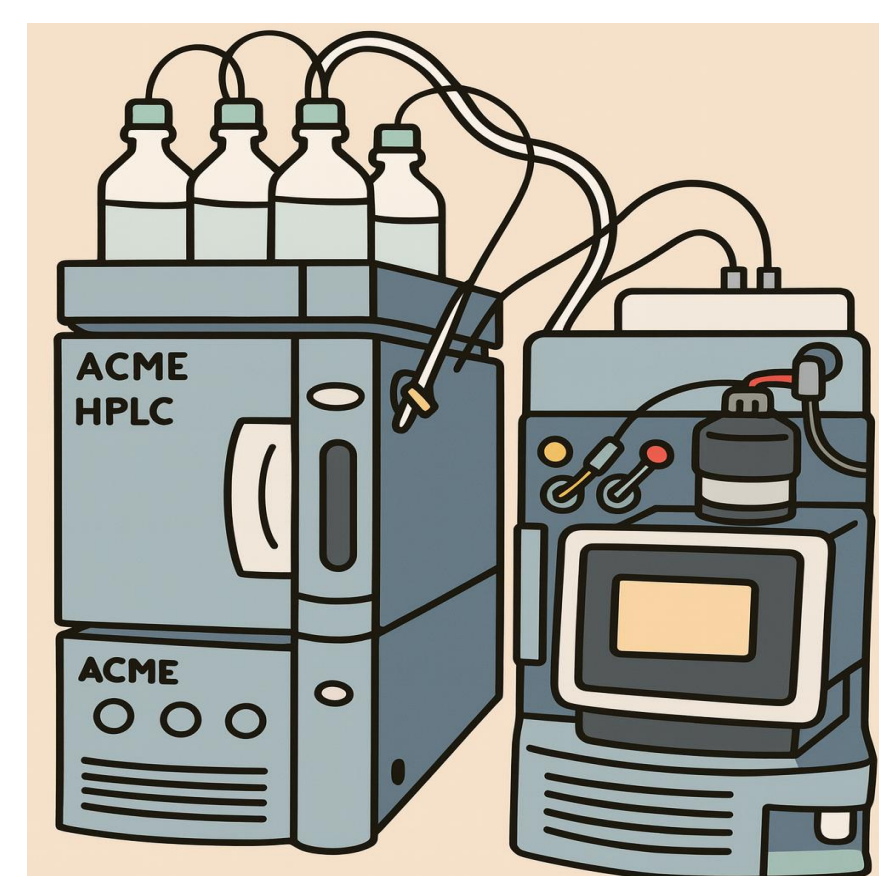


Figure 1b: HPLC-MS

Lengthy sample prep for complex matrices and analysis
Lengthy sample analysis
Sample prep and analysis confined to a laboratory setting
Limited testing methods available
Specialist training required

The aim is to develop a rapid, discriminatory, and sustainable method for pesticide detection in complex matrices using ASAP-MS.

My Research:

Atmospheric Solids Analysis Probe - Mass Spectrometry (ASAP-MS)

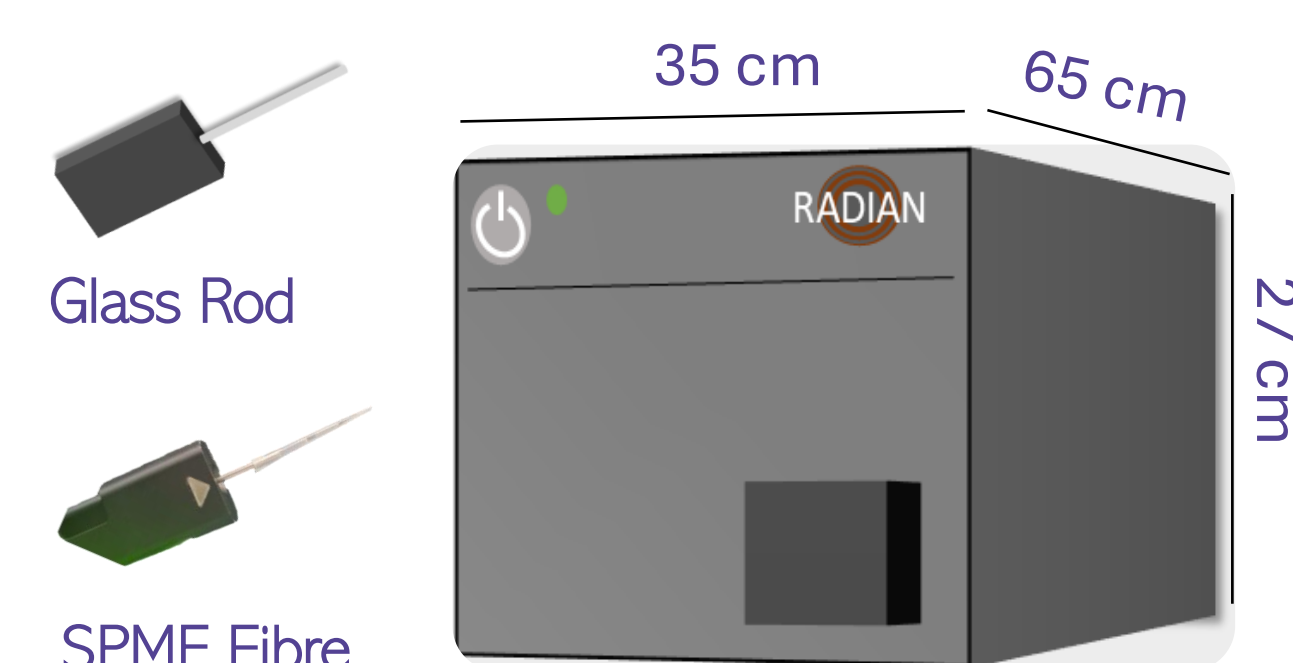
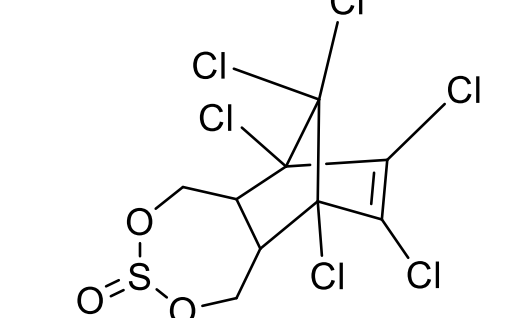
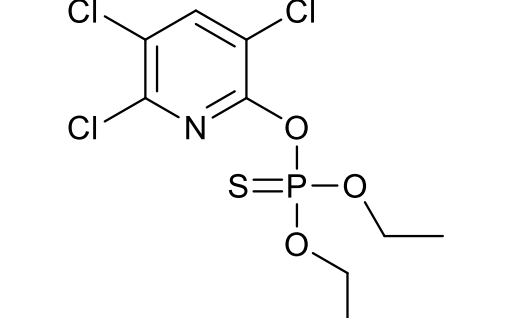
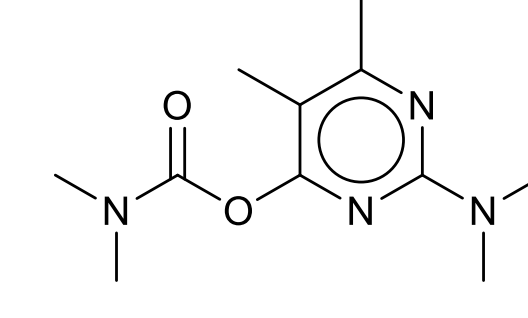
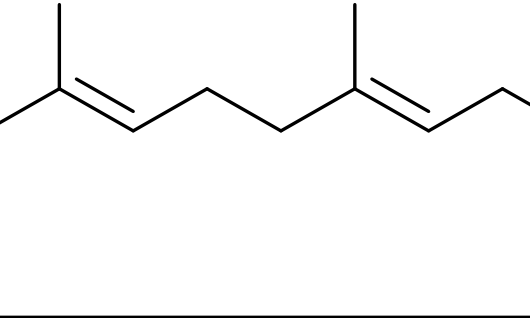
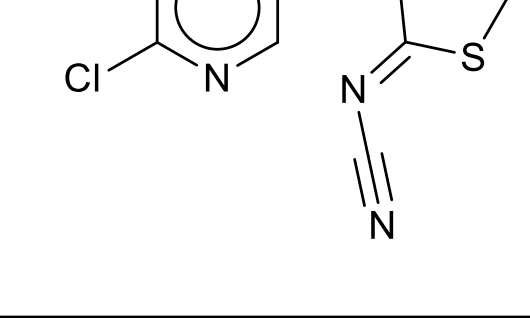
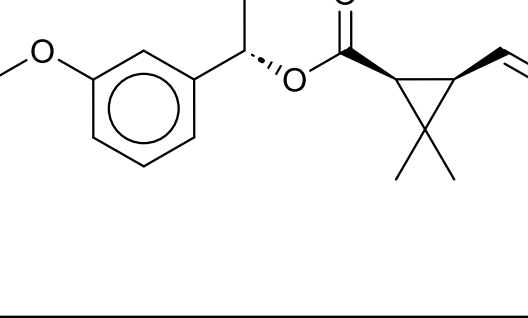


Figure 1c: ASAP-MS Instrument

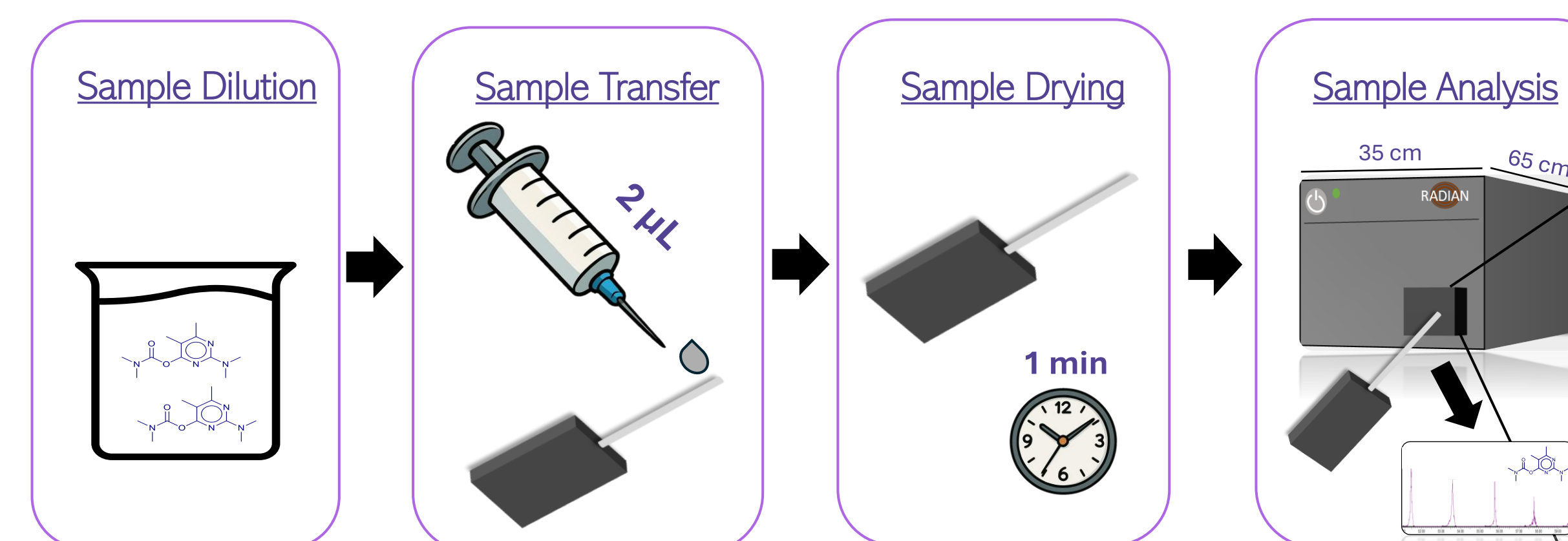
Minimal analysis time
Minimal sample prep with a glass rod
No specialist training required
Option for on-site analysis
Sustainable option for pesticide detection
Uses solid phase micro-extraction (SPME) for sensitivity

2: Experimental

Table 1: Pesticides used with chemical structure and pesticide categories

 Endosulfan I Organochlorine	 Chlorpyrifos Organophosphate	 Pirimicarb Carbamates
 Geraniol Botanicals	 Thiocloprid Neonicotinoid	 λ-Cyhalothrin Pyrethroids

Glass Rod-ASAP-MS Method



SPME-ASAP-MS Method

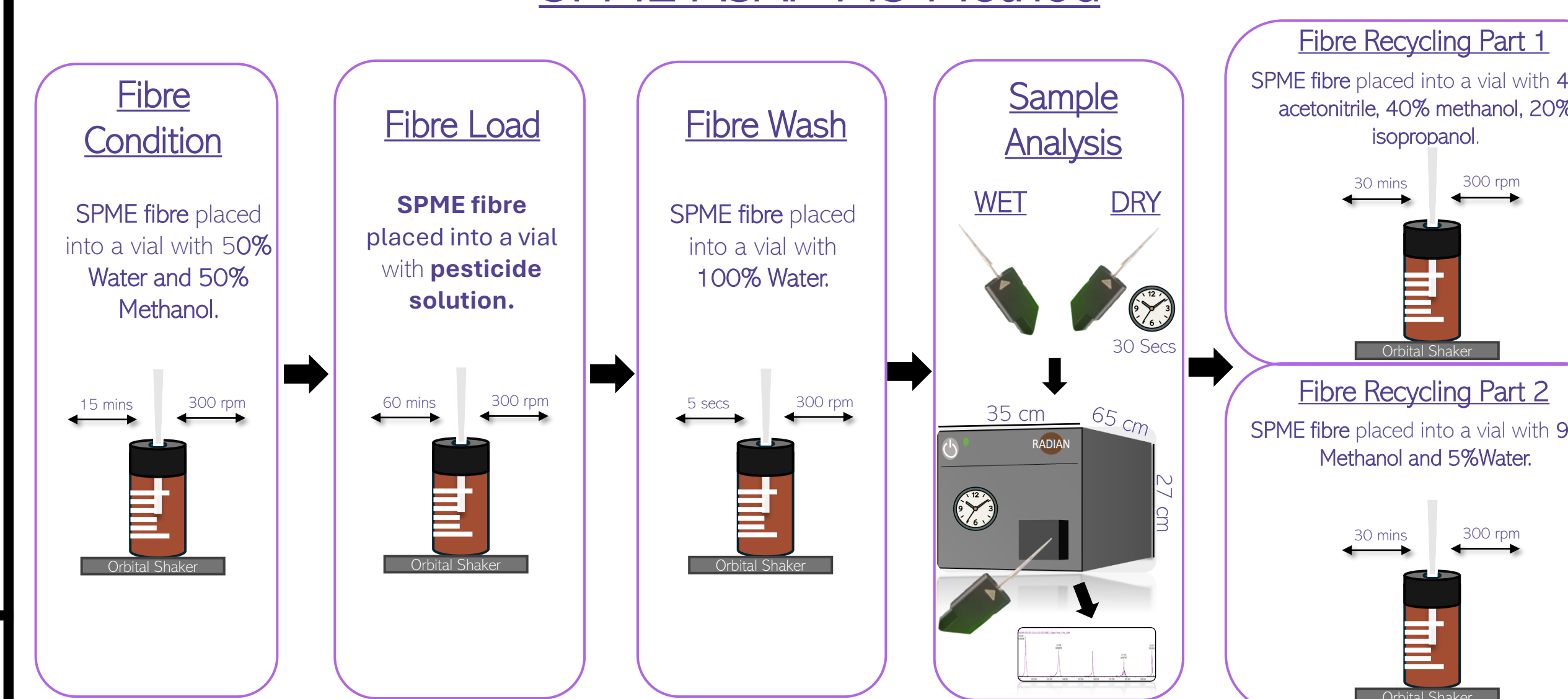


Figure 2a: Preparation and Analysis for pesticide standards

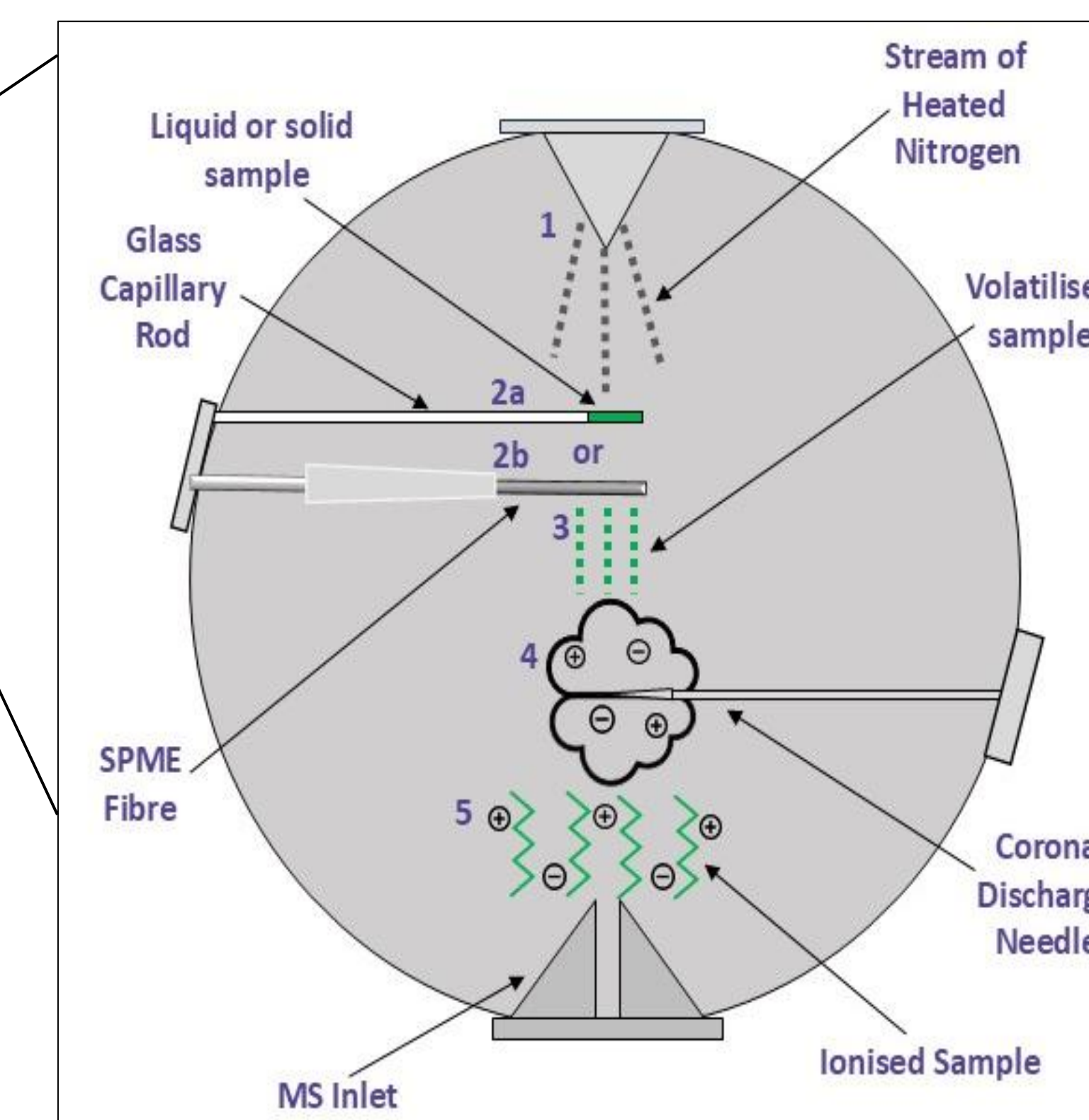


Figure 2b: Schematic of ASAP Ionisation Source. The SPME fibre can replace the glass rod.

3: Results

Table 2: Results of pesticide standards in surine using glass rods and SPME fibres

Pesticide	Glass Rod	SPME	SPME Type	SPME LOD (ppb)
Endosulfan I	✗	✓	Wet/Dry	10
Chlorpyrifos	✗	✓	Wet/Dry	0.1
Geraniol	✓	✓	Wet	0.1
Pirimicarb	✓	✓	Wet/Dry	0.1
Thiocloprid	✗	✓	Dry	0.1
λ-Cyhalothrin	✗	✓	Wet/Dry	100

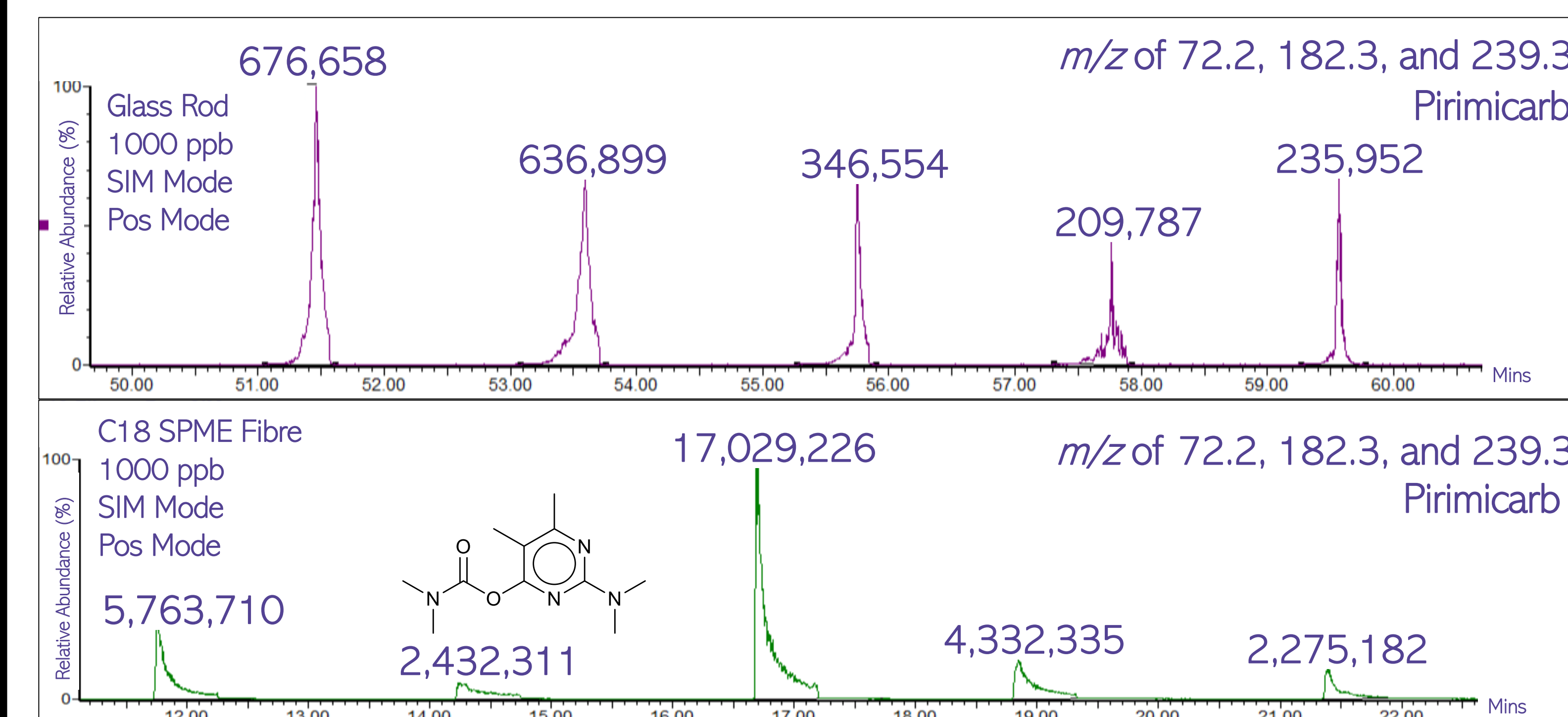


Figure 3a: Mass spectra for pirimicarb with glass rod and C18 SPME fibres at 1 part per million

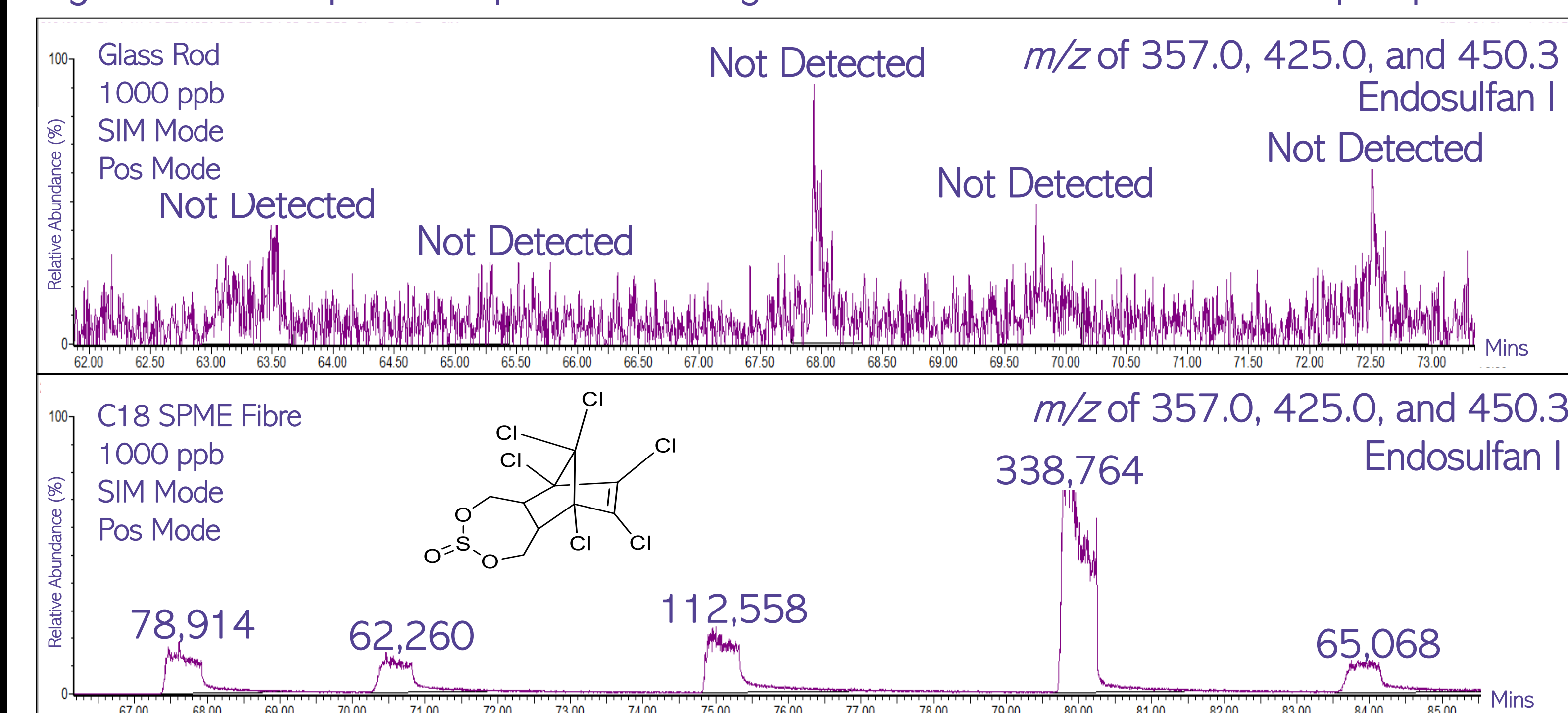


Figure 3b: Mass spectra for endosulfan I with glass rod and C18 SPME fibres at 1 part per million

4.1: Conclusion

Glass ASAP-MS and SPME-ASAP-MS are sustainable and portable methods.

Glass Rod-ASAP-MS	SPME-ASAP-MS
Limited sensitivity (higher than 1 ppm)	Improved sensitivity (down to 1 ppt)
Selected pesticides can be analysed	A range of pesticides can be analysed
Not recommended to be reused	Fibres are reusable

4.2: Future Work

Optimise the SPME method to reduce the sample preparation time
Optimise method for multi-pesticide standards, pesticide metabolites, and water as the matrix.
Optimise method for other complex matrices i.e. pesticide formulations, blood, honey and beeswax

Acknowledgments

Special thanks to Waters Corporation for the loan and use of the Waters RADIANT™ MS and Simone Mathias for the use of the Waters RADIANT™ schematic.

5: References

Menezes, R.G. et al. (2017) 'Endosulfan poisoning: An overview', Journal of Forensic and Legal Medicine, 51, pp. 27–33. Available at: <https://doi.org/10.1016/j.jflm.2017.07.008>. Yao et al. 2020. Rankin-Turner et al. 2023. Cartoon images generated by ChatGPTv5. Chemical structures created by ChemDraw 22.2.0 64-bit.

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