Determination of 242 Organic Compounds in Fog Water by GC-MS, GC-MS/MS, and LC-MS/MS

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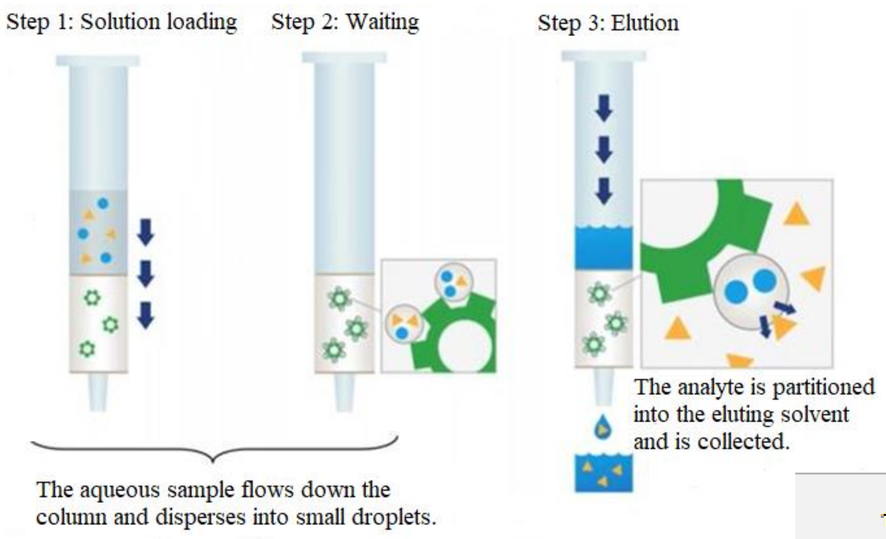
INTRODUCTION

- The analysis of organic matters in fog water has taken more attention in the last few years.
- The compounds of interests are: phenols, acids, pesticides (volatile and non-volatile), and **POPs** (**OCPs**, **PAHs,** and **PCBs)**.
- The extraction of the targeted compounds is performed by Solid-liquid extraction (SLE).
- The analytical quantification is done by GC-MS (phenols and acids), GC-MS/MS (POPs and volatile pesticides), and LC-MS/MS (non-volatile pesticides).

Extraction Method



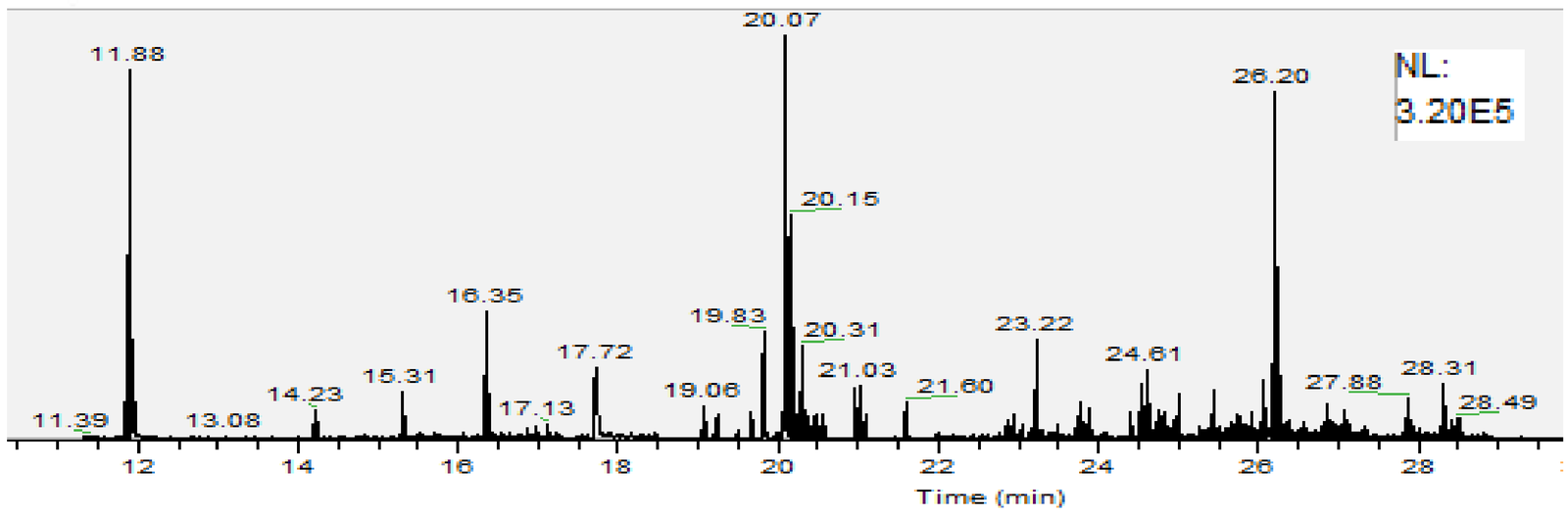
Chemical structures of organic compounds

Examples of chemical structures of:
(a). Phenanthrene, (b). PCB 28, (c). Chlortoluron, (d). Dichlobenil, (e). Aldrine, (f). Adipic acid, (g). Pentadecanoic acid, (h). 2,3,4-trichlorphenol

Case Study: PAHs, PCBs, and OCPs (POPs)

	Rate (°C/min)	Temp (°C)	Hold time (min)
Initial		50	3
Ramp 1	10	255	0
Ramp 2	20	330	18

GC-MS/MS conditions:
MS transfer line temp: 300°C
Ion source temp: 210°C
Ionization mode: EI
Gas flow: 1 ml/min
Split flow: 20 ml/min
Mode: Splitless



Concentration range of PAHs/PCBs/OCPs detected in fog samples taken from Alsace (France) and Lebanon during 2018 and 2021

Organic compounds	Concentration Range (ug/l)	
	Lebanon	Alsace
HAPs		
Naphtalene	19.92-55.76	13.85- 41.99
Acenaphtene	5.66-23.55	5.35- 11.94
Fluorene	41.69-69.58	2.93- 24.31
Phenanthrene	203.26-313.24	8.12- 60.69
Anthracene	70.843-207.71	4.20- 19.91
Fluoranthrene	126.75-230.12	16.22- 112.37
Pyrene	149.45-253.8	12.43- 102.48
Benzo(a)anthracene	135.75-452.55	13.61- 495.99
Benzo(b)fluoranthrene	7.12	178.12
Benzo(k)fluoranthrene	84.78	308.12
Benzo(e)pyrene	119.1	97.22
Benzo(a)pyrene	421.55	86.72- 355.66
OCPs		
α-HCH	3.48-17.7	1.92- 4.49
γ-HCH	7.12-36.46	5.39- 9.98
PCBs		
PCB118	6.39-100.96	28.32- 42.44
PCB123	-	3.45

- Validated for its precisions, recovery, and linearity
- Low LOD and LOQ, $R^2 > 0.98$, and % RSD < 20 are achieved.
- Applied on real fog samples.
- Most organic compounds are extracted by SLE.

Conclusions

- The use of SLE coupled with GC-MS, GC-MS/MS, and LC-MS/MS enables the determination of a wide variety of emerging environmental organic compounds in one matrix.
- The applicability of this method on real fog samples taken from Lebanon and Alsace (France) shows a potential risk of different environmental pollutants.

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