Comparison and calibration of diverses adsorbents for passive sampling of pesticides in air during a sampling campaign at a regional scale

Lévy Marine[1], Pallares Cyril[2], Pham-Huu Cuong[1], Millet Maurice[1]

[1] *ICPEES (UMR 7515 CNRS-Unistra) 1, rue Blessig 67084 Strasbourg Cedex – mmillet@unistra.fr*

[2] *Atmo Grand-Est 5, rue de Madrid 6300 Schiltigheim – cyril.pallares@atmo-grandest.eu*

Introduction

- Collaborative campaigns
- 3 years
- 102 pesticides: 41 H, 36 F, 23 I, 2 S

Introduction

- Collaborative campaigns
- 3 years
- 102 pesticides: 41 H, 36 F, 23 I, 2 S

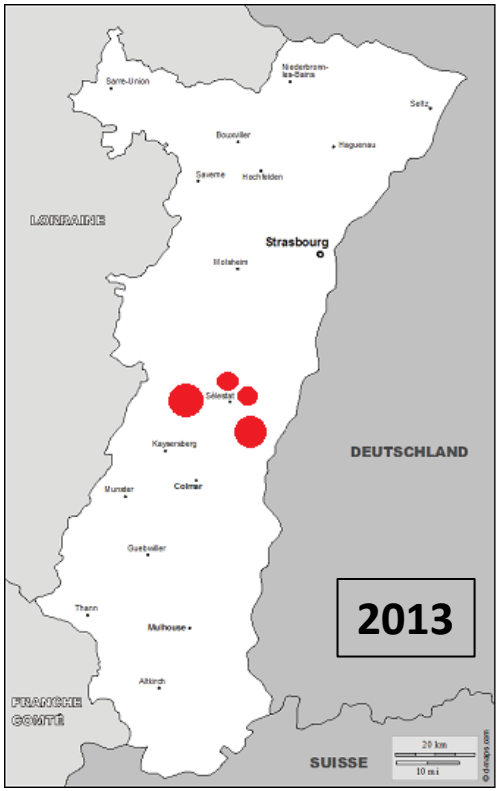
⇒ Active/passive comparison
⇒ Compare passive adsorbents
⇒ Calculate SR

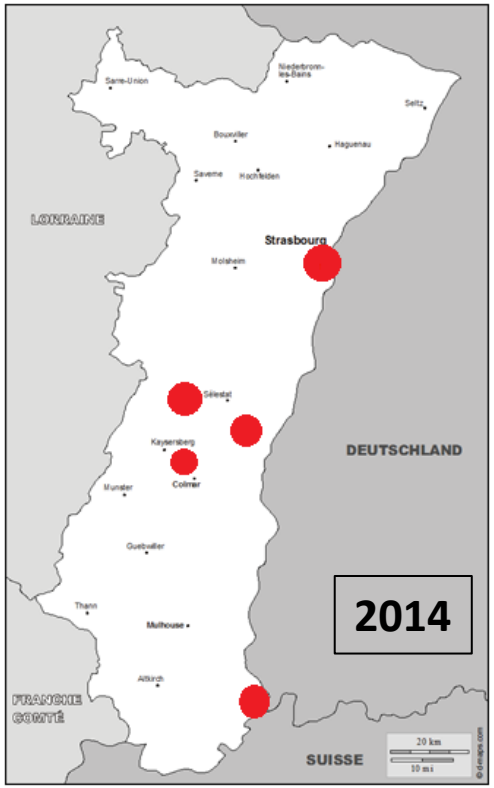
Air sampling

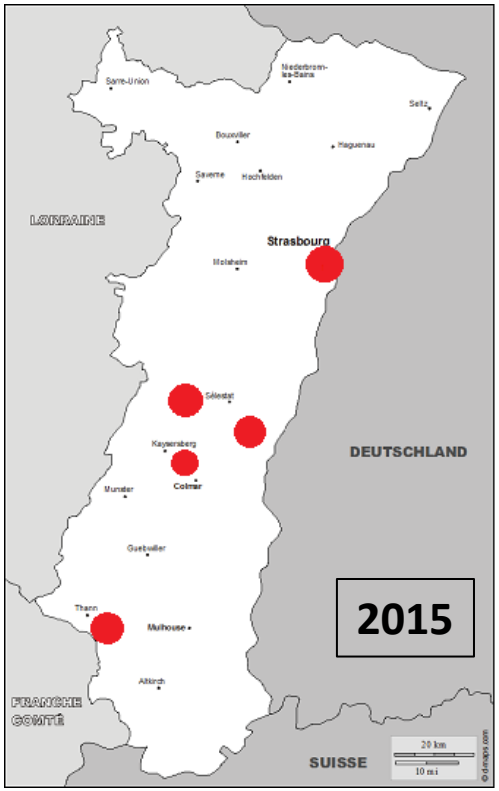
- 4 to 5 sites

Air sampling

- 4 to 5 sites







Air sampling

- 4 to 5 sites





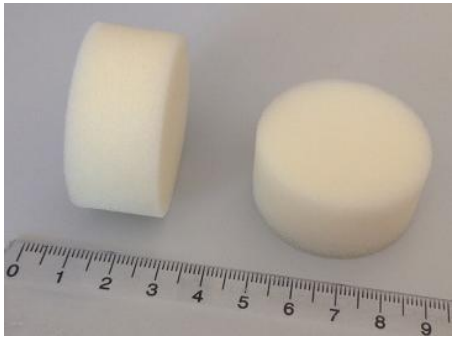
Air sampling

- 4 to 5 sites

- 5 weeks total
- 1 to 2 weeks at a time

Air sampling

- Active



- Passive

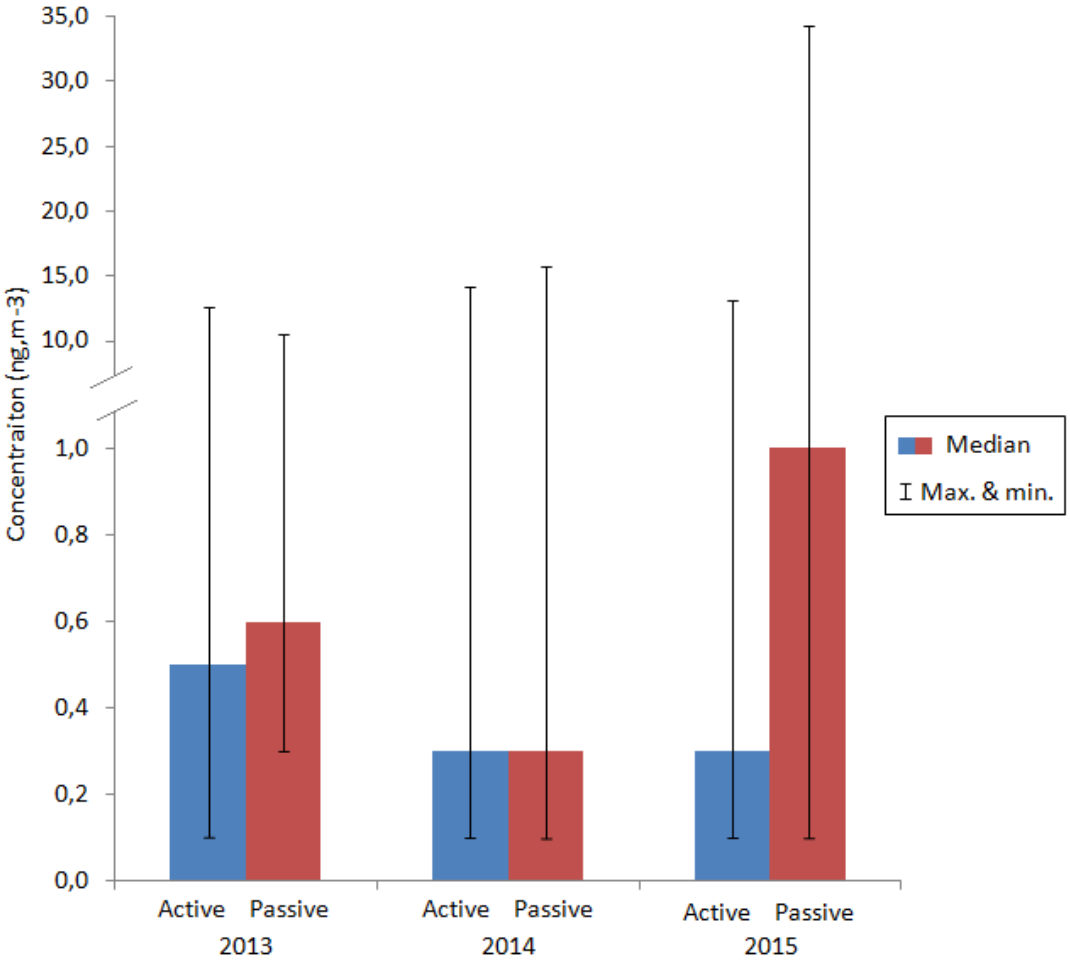
Analytical method

Anlytical method

	ng sampler^{-1}	
	LOD	LOQ
Minimum	0.1	0.3
Maximum	29.0	87.0
Average	11.4	34.2
Median	1.4	4.2

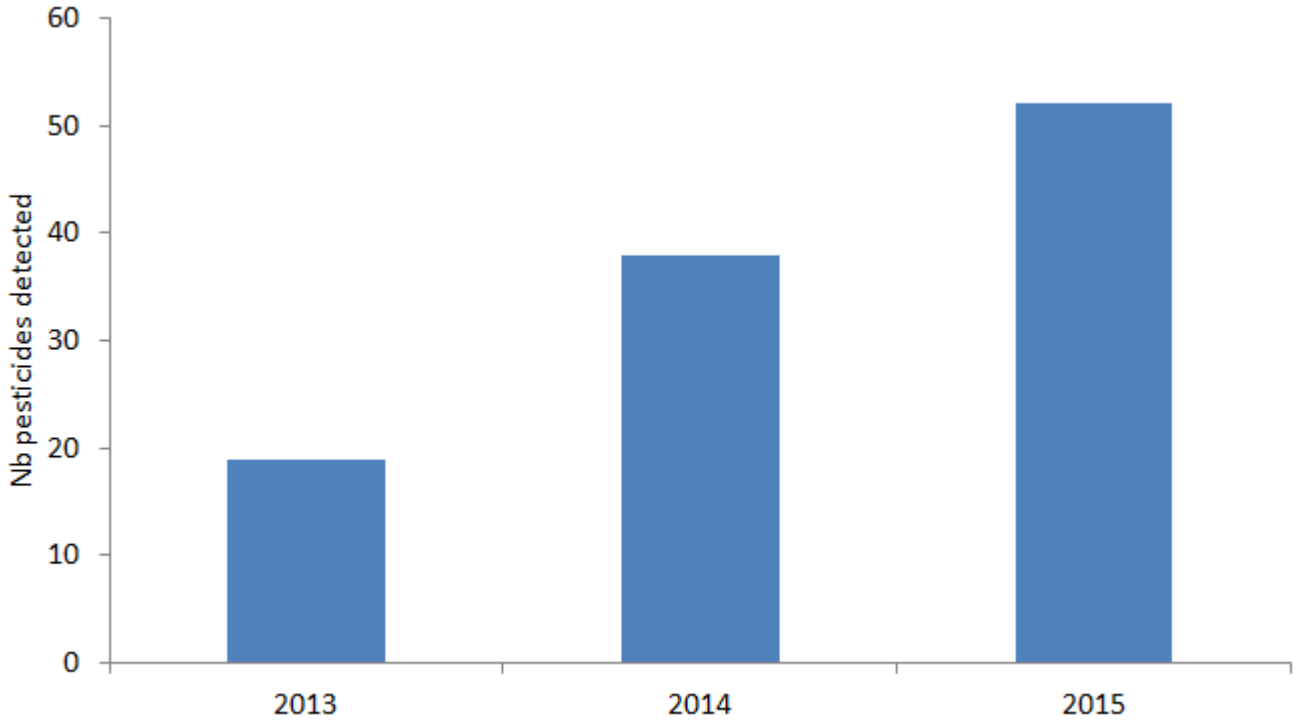
Results

- Agreement between active and passive samplers



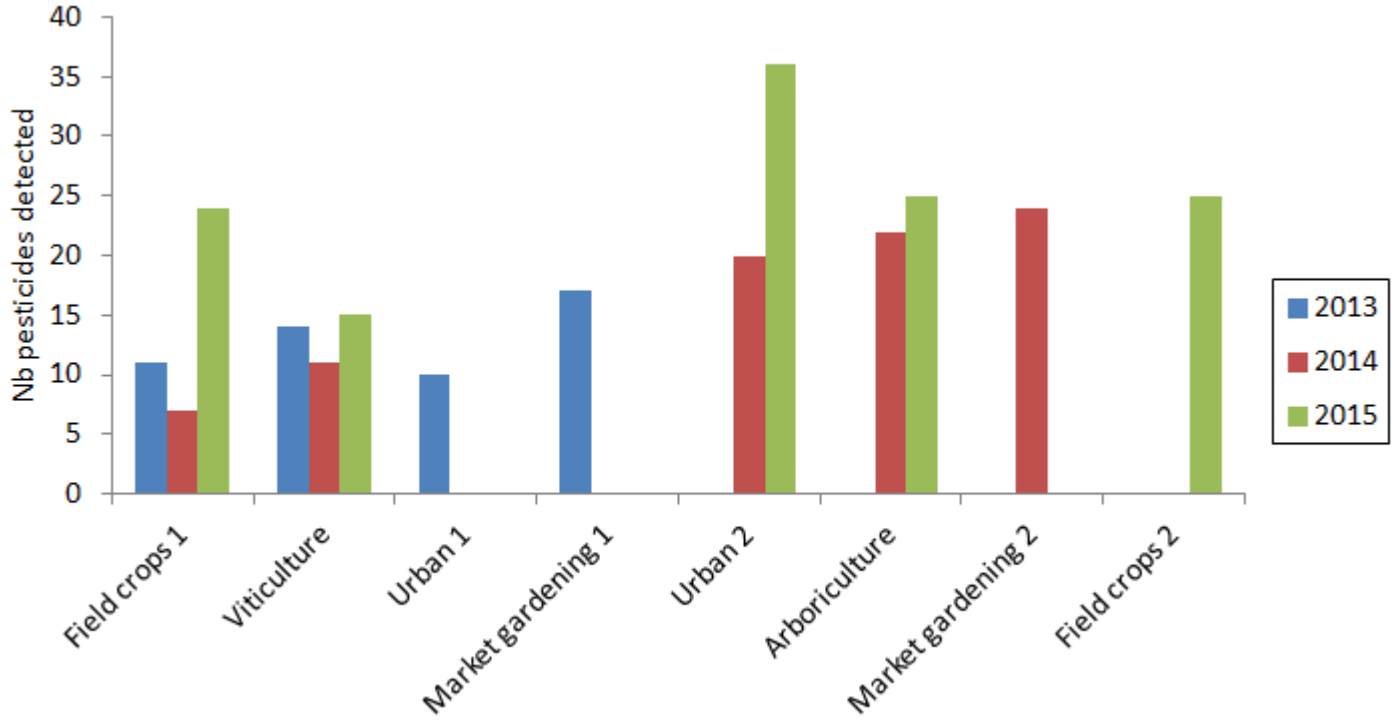
Results

- More pesticides each year



Results

- More pesticides each year



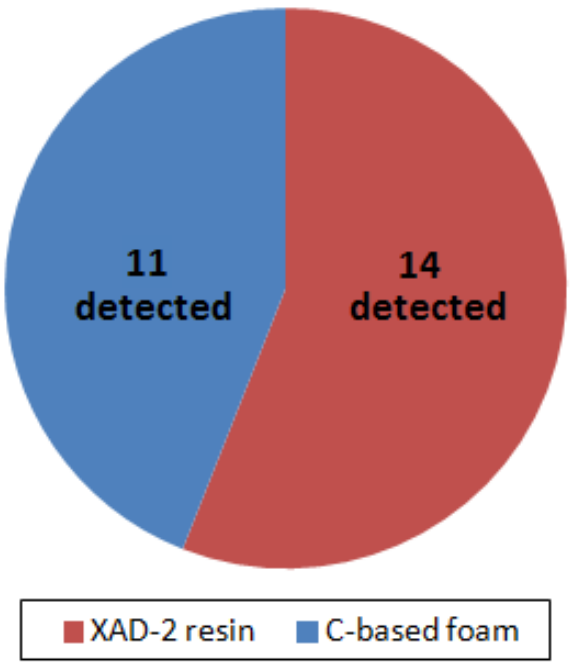
Results – Comparing adsorbents

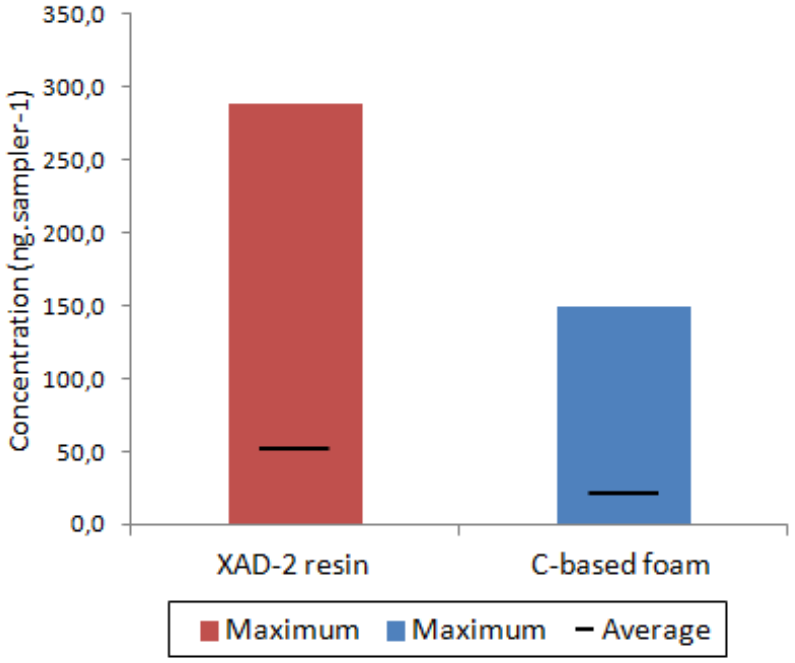
	XAD®-2 resin	C-based foam
Specific surface area	300 $m^2\ g^{-1}$	30 $m^2\ g^{-1}$
Pore diameter	9 nm	510-4000 µm
Hydrophobicity	++	+

Wania et al., **2003**, *Environmental Science & Technology*, *37*, 1352-1359
Liu et al., **2013**, *Journal of Materials Chemistry A*, *1*, 9508-9516
Liu et al., **2013**, *Chemical Engineering Journal*, *222*, 265-273

Results – Comparing adsorbents

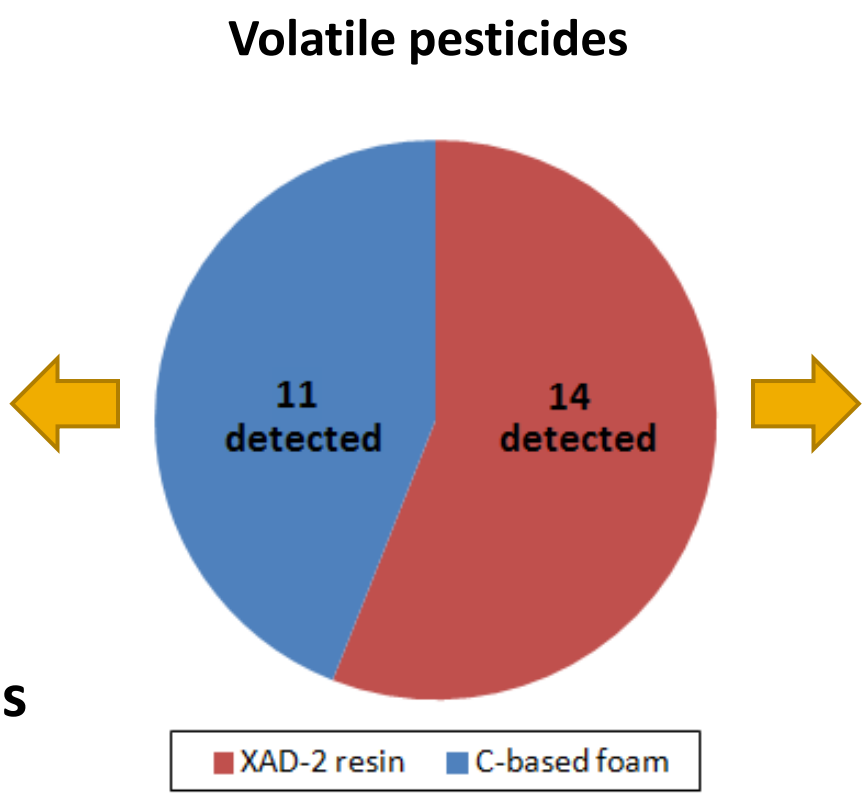
Volatile pesticides





Results – Comparing adsorbents

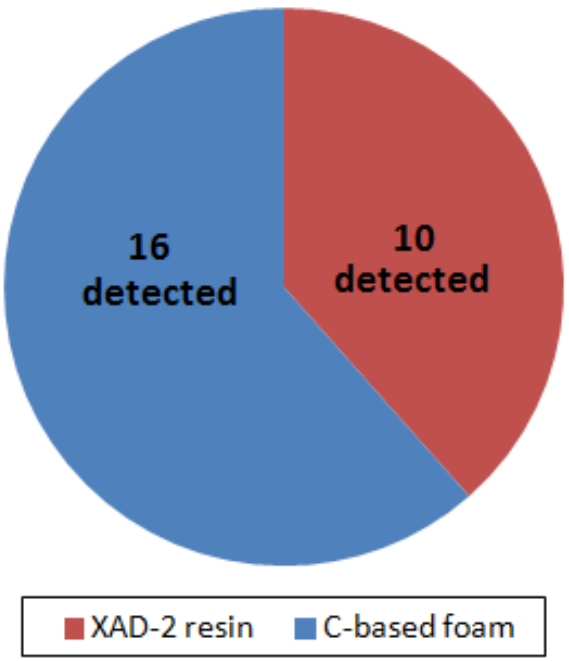
- **4 polar** :
  2,4-MCPA
  Bromoxynil
  Mecoprop-p
  Triclopyr
- **10 detections**

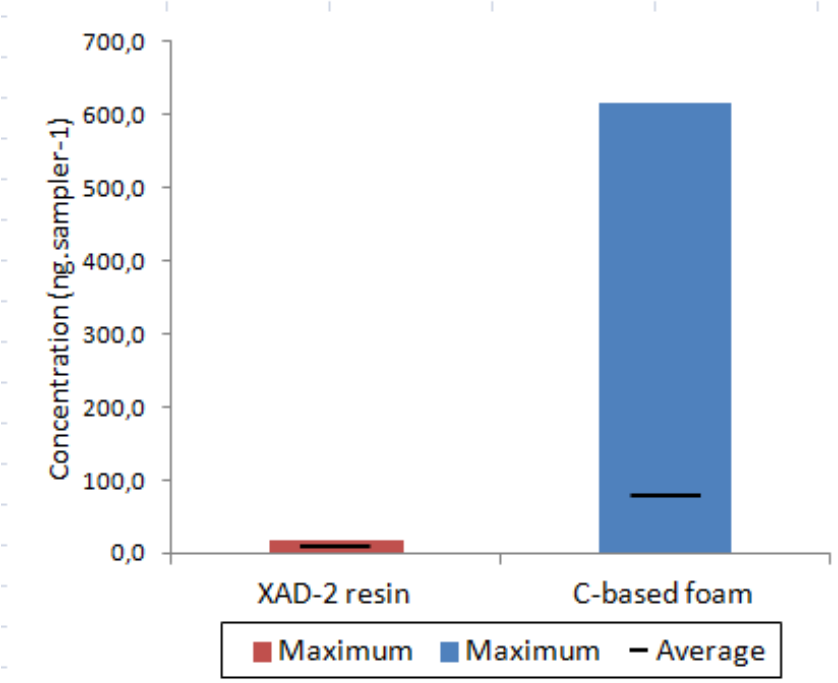


- **1 polar** :
  2,4-MCPA
- **1 detection**

Results – Comparing adsorbents

Semi-volatile pesticides





Results – Comparing adsorbents

	XAD®-2 resin	C-based foam
Air phase	Gas	Particles
Target pesticides	Hydrophobic pesticides	Polar pesticides

Results – Sampling rates

- Active/passive comparison

$$SR = \frac{M_{PAS}}{C_{air} \times t}$$

Results – Sampling rates

- Active/passive comparison

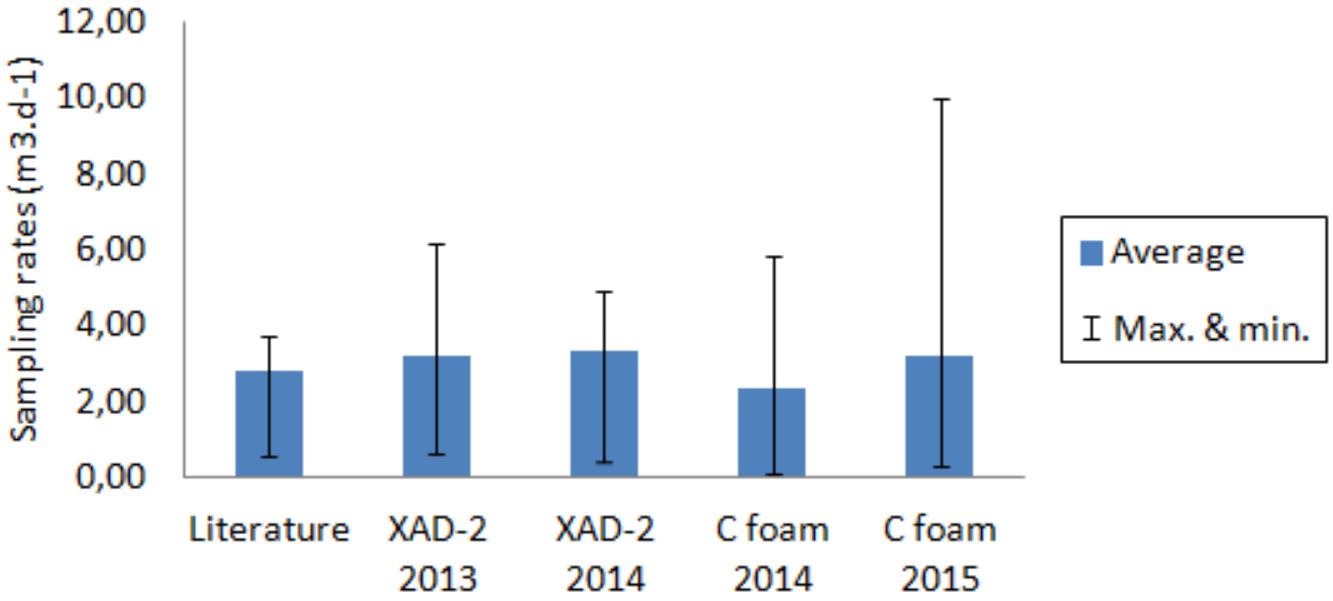
$$SR = \frac{M_{PAS}}{C_{air} \times t}$$

Results – Sampling rates

- Active/passive comparison

$$SR = \frac{M_{PAS}}{C_{air} \times t}$$

Results – Sampling rates



Wania et al., **2003**, *Environmental Science & Technology*, *37*, 1352-1359
Gouin et al., **2008**, *Environmental Science & Technology*, *42*, 6625-6630
Xiao-Ping et al., **2010**, *Environmental Science & Technology*, *44*, 2988-2993

Results – Sampling rates

	Literature	2013	2014		2015
	XAD®-2	XAD®-2	XAD®-2	C-based foam	C-based foam
Minimum	0.60	0.66	0.43	0.08	0.28
Maximum	3.70	6.14	4.91	5.82	9.97
Average	2.78	3.23	2.32	2.33	3.21

Wania et al., **2003**, *Environmental Science & Technology*, *37*, 1352-1359
Gouin et al., **2008**, *Environmental Science & Technology*, *42*, 6625-6630
Xiao-Ping et al., **2010**, *Environmental Science & Technology*, *44*, 2988-2993

Results – Sampling rates

- Different materials
- Good approximation

- C-based foam: greater variability

Conclusion

- Active and passive sampling
  - ➡ similar results
- Passive samplers
  - ➡ C-based foam more versatile
- Sampling rates
  - ➡ similar to the literature
  - ➡ similar to each other