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Calibration and field evaluation of passive samplers for monitoring pesticides in water

Background

- The continuous emissions of pesticides to the aquatic environment are posing a risk to wildlife and human health
- The concentrations of pesticides in water vary temporally due to fluctuations in flow, precipitation, or episodic inputs
- Passive sampling is a promising tool, allowing for continuous monitoring of an aquatic system over extended period of time
  - *i)* time-weighted mean concentrations (TWMC)
  - *ii)* an easy tool to use
  - *iii)* high sensitivity due to collection of large volumes of water

Table 1. Overview of passive sampling devices for pesticides

POCIS A: Pharmaceutical-POCIS, polar organic chemical integrative sampler (Oasis hydrophilic–lipophilic balance (HLB) sorbent)
POCIS B: Pesticide-POCIS, Triphasic sorbent admixture (Isolute ENV+ and Ambersorb 1500) enclosed in a polyethersulphone membrane
Chemcatcher® SDB-RPS: Styrene divinyl benzene Empore™ disk
Chemcatcher® C18: Empore™ disk
Silicone rubber (SR)
Low-density polyethylene (LDPE)

POCIS A, or B, Chemcatcher® SDB-RPS, or C18

SR, or LDPE

Material and Methods

- Comparison of six different passive sampler types:
  i) POCIS A, *ii)* POCIS B, *iii)* Chemcatcher® SDB-RPS, *iv)* Chemcatcher® C18, *v)* silicone rubber (SR), and *vi)* low-density polyethylene (LDPE) **(Table 1)**
- Laboratory-based uptake study for individual pesticides
- Evaluation of performance reference compounds (PRCs)
- Field application of passive samplers at two monitoring stations in Southern Sweden (Skåne and Halland)

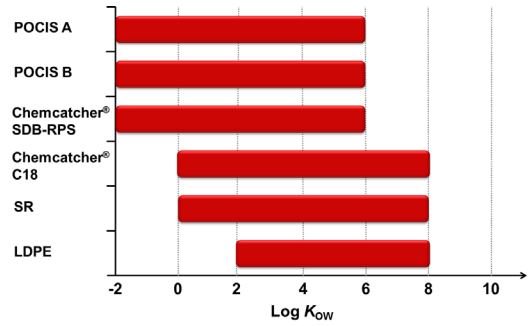

Figure 1. Application of different passive samplers for pesticides depending on the n-octanol–water partition coefficient (K_{OW})

Objectives

- Characterization of passive samplers for over 100 individual pesticides in water
- Evaluate the performance of passive samplers in comparison to time integrated active sampling
- Evaluate the concept, challenges and application of passive sampling for future monitoring strategies in Sweden

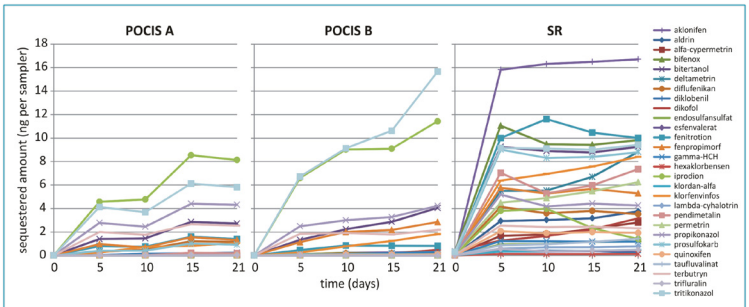

Figure 2. Uptake curves for selected pesticides in POCIS A, POCIS B and SR

Conclusions

- The n-octanol–water partition coefficient (K_{OW}) has been shown to be a good parameter to predict the suitability of the passive sampler for pesticides **(Figure 1)**
- The different passive sampler types tested in this study are suitable for measuring pesticides in Swedish rivers
- POCIS A and POCIS B showed a better uptake performance for more polar compounds (log K_{OW} < 0), whereas more hydrophobic compounds (log K_{OW} > 6) were better taken up by SR and LDPE **(Figure 2)**
- Overall, the results of this study will improve our understanding of the concept, challenges and application of passive sampling for future monitoring strategies of pesticides in water
- More work is required to compare the passive sampler results with active sampling in the field

References

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- Kreuger, J (1998). Pesticides in stream water within an agricultural catchment in southern Sweden, 1990-1996. *Sci Total Environ* 216: 227–251
- Directive 2013/39/EU of the European Parliament and of the Council of 12 August 2013 amending Directives 2000/60/EC and 2008/105/EC as regards priority substances in the field of water policy
- http://www.slu.se/ckb (Centre for Chemical Pesticides, Sweden)