Results of the ICES workshop on the application of passive sampling and passive dosing to contaminants in marine media (WKPSPD)

(authors next page)
## Participants

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With kind assistance of Vivian Piil
and support by Claus Hagebro, Erik Olsen
Application of passive sampling and passive dosing to contaminants in marine media (WKPSPD)
Advise to ICES

• experience with Passive Samping and Passive Dosing (PS&PD)
• application of PS&PD in compliance monitoring (WFD, MSFD and RSC).
  o Evaluate current knowledge for its practical applicability;
  o Ways to link PS to chemical monitoring and effect monitoring in biota
  o Investigate how a monitoring system based on PS/PD could be conceived;
• consider the legal aspects
• research needs and challenges
1. Compliance Monitoring
2. Passive sampling of marine and transitional waters
3. Passive sampling of sediment
4. Linking passive sampling to concentrations in biota
5. Passive sampling/dosing and toxicity testing
Protect

- pelagic organisms ($\leftarrow C_{\text{free}}$ in water)
- benthic organisms ($\leftarrow C_{\text{free}}$ in pore water)
- predators ($\leftarrow C_{\text{prey}}$)
- humans ($\leftarrow C_{\text{food}}, C_{\text{drinking water}}$)

Current practice: other targets than $C_{\text{free}}$ for pragmatic reasons ($C_{\text{wtotal}}, C_{\text{sed}}, C_{\text{biota}}, C_{\text{SPM}}$)
Compliance Monitoring

• Requirements OSPAR
  – assessment criteria
  – guidelines
  – QA/QC
  – proficiency testing schemes (QUASIMEME, PT-WFD)

• Requirements WFD
  – EQS in water + some EQS in biota
  – QA/QC, PTS, guidelines.....
  – no scientific basis EQS based on total water
Compliance Monitoring

• For which compounds is PS OK?
  – PCBs, PAHs, PBDEs, HCBD and HCB, HBCD (nonpolar PSD): yes
  – PFOS: no
  – Dicofol, heptachlor/heptachlor epoxide and dioxins: possibly
  – metals: unclear
  – polar contaminants: no
Compliance Monitoring

- Standardization of PSDs: not advisable
- Interlab variability: still huge but can be expected to decrease in PTS
PS marine/transitional waters

• Applied widely in surveillance monitoring.
• Nonpolar PSD: mature, suitable for compliance monitoring
• Polar PSD: not mature enough
• Uncertainties (nonpolar PSD)
  – wrong model: kinetic/equilibrium (huge, but avoidable))
  – analytical (minor)
  – calculation (huge, but avoidable)
  – $K_{sw}$ (major)
PS of sediments (nonpolar)

- $C_{\text{free}}$ in pore water
- Accessibility in solids phase
- Easier and better link with toxicity
- PSD-sed equilibrium on reasonable time scales
Linking PS to $C_{\text{biota}}$

- Measure the lipids
  - Incubating polymers and lipids brings all $C_{\text{biota}}$ on the same scale
  - $K_{\text{polymer-lipid}}$ needed (absorption of lipids by the polymer has minor effect)

- Correlate PS-biota
  - Nice correlations between PS and biomonitoring data. But site specific differences.
  - Similar variability in monitoring series
  - Biomonitoring still needed for food safety and predator protection
Link $C_{\text{sed}}$ and $C_{\text{biota}}$ via equilibrium PS? (in development)
Passive sampling/dosing and toxicity testing (in development)

- PD→ Mixture toxicity testing for nonpolar
- Full equilibrium: mimick $C_w$ in tox test
- Partial equilibrium: effects of high $K_{ow}$ compounds underestimated
- sulphur toxicity
- separate effects of nonpolar from other water quality parameters
- How many tox tests do we need?
Conclusions 1

• RSC/WFD: Effects $\sim C_{\text{free}}$ (aquatic and benthic toxicity)
  o Nonpolar PS in water or sed. + (mature)
  o Polar PS - (not yet)
  o Metals ? (unknown)

• Link PS of nonpolars to existing series?
  – biota: yes (could depend on location)
  – sediments: yes (could depend on location)
  – total water: yes (will depend on [SPM])
Conclusions (*ctnd.*).

- Work to be done for nonpolars PSDs
  - Guideline for $K_{sw}$ (→WGMS/MCWG)
  - Go back to EQS/EAC in terms of $C_{\text{free}}$ (→WGBEC,...)
  - Proficiency testing scheme (→MCWG, QUASIMEME)
  - Guideline on PS of sediments (WGMS/MCWG)
  - Add passive sampling water/sed to pre-CEMP (→OSPAR)

- Work to be done for polar PSDs
  - develop quantitative models (← anyone)

- Work to be done for metal PSDs
  - Evaluate if PSDs better link with toxicity (← anyone)