AMEG: The New SETAC Advisory Group in Aquatic Macrophyte Ecotoxicology

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Why macrophytes?

Key species in the aquatic environment:

- Production of organic matter and oxygen,
- control of nutrient cycling and nutrient availability in the water layer,
- sediment stabilization,
- food resource as well as
- habitat and shelter for aquatic fauna including fish

A healthy and diverse macrophyte community increases species diversity and water quality
Why AMEG?

- Born of the international workshop on aquatic macrophytes in risk assessment – **AMRAP** (Netherlands, 2008)

Consensus of AMRAP workshop members (Academia, government and industry):

- **Current Risk Assessment (RA) for pesticides does not assure adequate protection for aquatic macrophytes concerning some pesticides**
Macrophytes in risk assessment

General RA procedure for plant production products:

Tier 1: Standardized laboratory tests (algae, water flea, fish)

- An additional macrophyte test is required if a herbicide is tested

**Chronic Test** (EC No.1107/2009)

*Duckweed Lemna spp.*

- rooted, free floating, monocot
- fast growth and high potential for recovery

*Lemna test may not be sensitive for some herbicides that adsorb to surfaces or have a certain mode of action*
Example Irgarol

**Pond Mesocosm study**
- herbicidal biocide used in antifouling paints
- highly effective photosystem II inhibitor

**Environmental concentrations:**
- up to 4.1 µg/L (seawater)

**EC-50**
*Myriophyllum verticillatum* (mesocosm): 0.21 µg/L
*Lemna minor* (laboratory): 8.7 µg/L
Aims of AMEG

- Development of guidance and tools for aquatic macrophyte risk assessment
- Communication and education
- Function as a discussion platform: webpage, SETAC meetings
- Build up of a world wide network of scientists from University, government and industry

AMEG needs you!
Current AMEG working groups

- Proposal for a modified aquatic macrophyte Tier 1 risk assessment scheme for plant protection products
- Protocol for a laboratory toxicity test with *Myriophyllum* spp. to be ring-tested in 2010
- Collation of a database of macrophyte species and test methods based on current experiences
- Development of criteria and guidance on species and endpoints and their use in Species Sensitivity Distributions (SSDs)
Test guidance for *Myriophyllum*

**Macrophytes:** *M. spicatum* or *M. aquaticum*

**Medium:** Smart and Barko

**Sediment:** artificial sediment (OECD 219)  
addition of nutrients (N and P)

**Light:** 100-120 µE·m⁻²·s⁻¹

**Test duration:** 7-14 days

**Temperature:** 20 ± 2°C

**Endpoints:** Biomass, length, fluorescence

- Ring testing will start soon!
- Test substance: 3,5-Dichlorphenol (3,5-DCP)

You can still contribute!
First pre-test results

*Myriophyllum spicatum*

Data from BASF laboratory
by Johanna Kubitza and Peter Dohmen

Data from UBA Laboratory
by Andreas Hünken and Carola Kussatz

- Good growth, little variation
Species sensitivity distributions (SSD)

- Development of SSDs for estimating hazardous concentrations using the EC-50 of several species for one substance
- HC5: concentration for which most plants should be safe

Open questions:
- Which endpoints, which plants (monocots, dicots, submerged, emerse) should be integrated?
- Should only be the most sensitive endpoints included?

Data collection:
- 2000 endpoints for 54 compounds, 55 freshwater macrophytes
- EC-50 variation within species is greater than that between species

More published data are needed!
Emerging directions

- **Management of invasive macrophytes**
  - In context of climate change
  - What consequences for indigenous species?

- **Tropical effect assessment**
  - Transfer of technologies and evaluation criteria to tropical regions possible?
  - Which indigenous species are representative for tropical ecosystems?

- **Restoration and bioremediation**
  - Green liver concept

Mohr et al.: AMEG: The New SETAC Advisory Group in Aquatic Macrophytes Ecotoxicology
**Green liver concept**

Plants exhibit metabolisation of toxic compounds by deposing toxic substances into cell wall components

- Use of bioaccumulation potential of macrophytes for reduction of nutrients, heavy metals or algal toxins from waste or polluted surface waters

**Nimptsch et al. 2008 (EST):**

- Pilot pond system at Hefei Water works, Lake Chao, China
- Testing algal toxin elimination efficiency by different macrophyte species

Photo kindly provided by S. Pflugmacher
Hefei pilot pond system - results

Before       Hydrilla sp. - Myriophyllum sp. - Phragmites sp.       After

- Up to 84% Reduction of the algal toxin microcystin depending on plant density from raw lake water (toxin concentration below WHO guideline for drinking water)
- More research and technical realization is needed
How to contribute?

- You can become actively involved in the various working groups
- Become a member via your SETAC profile
- Next AMEG Meeting at SETAC Europe 2010 in Seville, Spain
- AMEG publication in ESPR journal

http://www.setac.org/node/11
Thanks!

For your attention

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