

The Pyrethroid Challenge

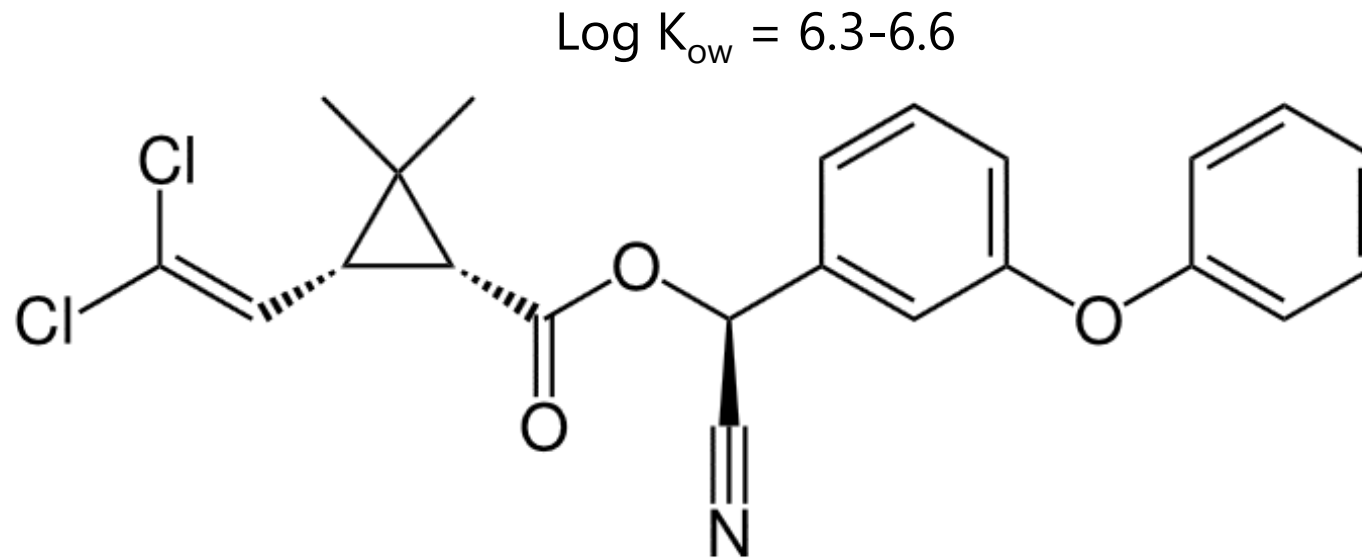
Natural organic matter coated particles as vectors for pyrethroid exposure in stream water

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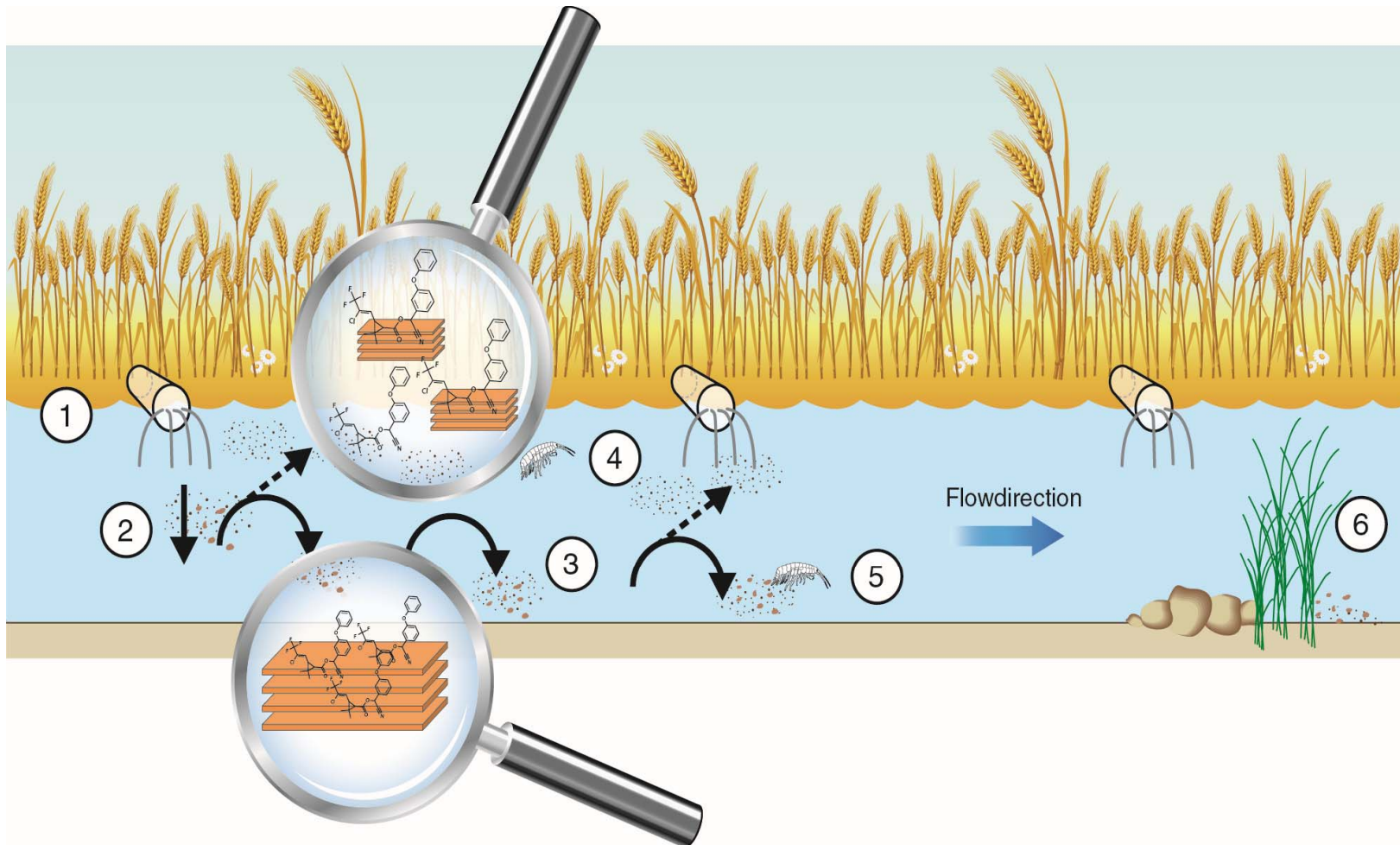


Cypermethrin – a hydrophobic insecticide



- Cypermethrin has been found in surface waters
- Particles transport cypermethrin
- Particle bound cypermethrin has been found to be toxic
- Leaching of fine particles happen in pulses, approx. 60 min (rain events)

Effect of particle-associated pyrethroids for toxicity towards freshwater macroinvertebrates

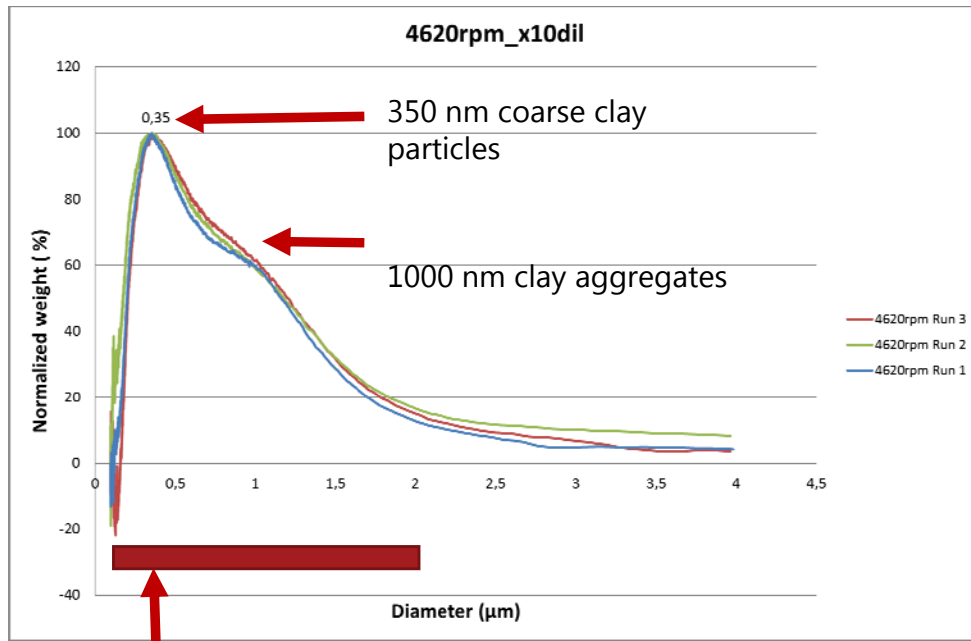


Aim

- To determine the potential of goethite and montmorillonite to act as vectors for cypermethrin transport with and without coating with organic matter
- Goethite
- Goethite + DOM coating
- Montmorillonite
- Montmorillonite + DOM coating
- Particle size distribution in Göteborg @Geert Cornelis lab

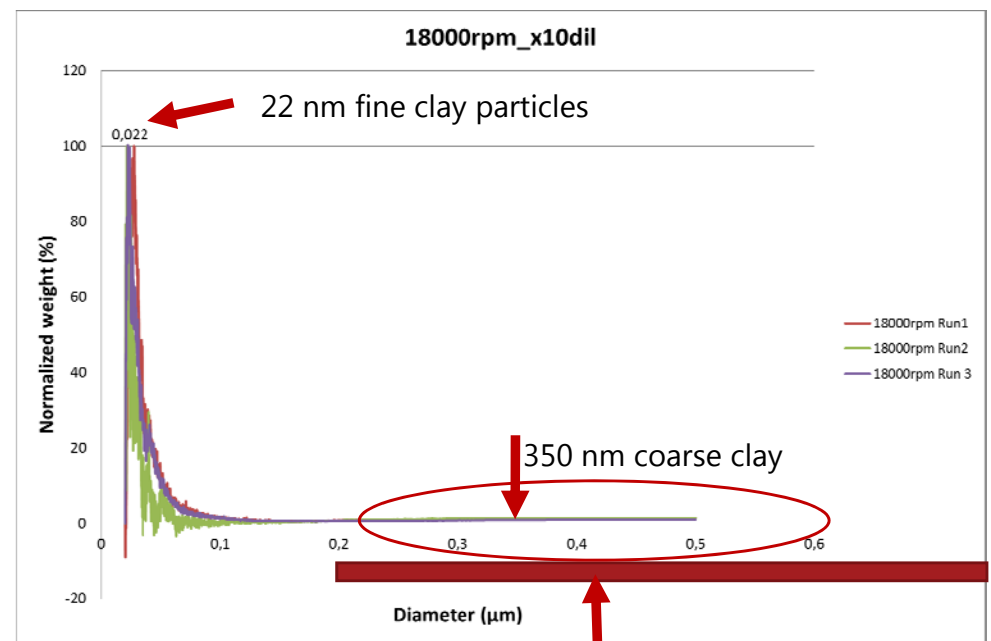
Particle properties for pyrethroids sorption

**Montmorillonite coarse fraction in 3 replicates
100 - 4000 nm (low resolution)**



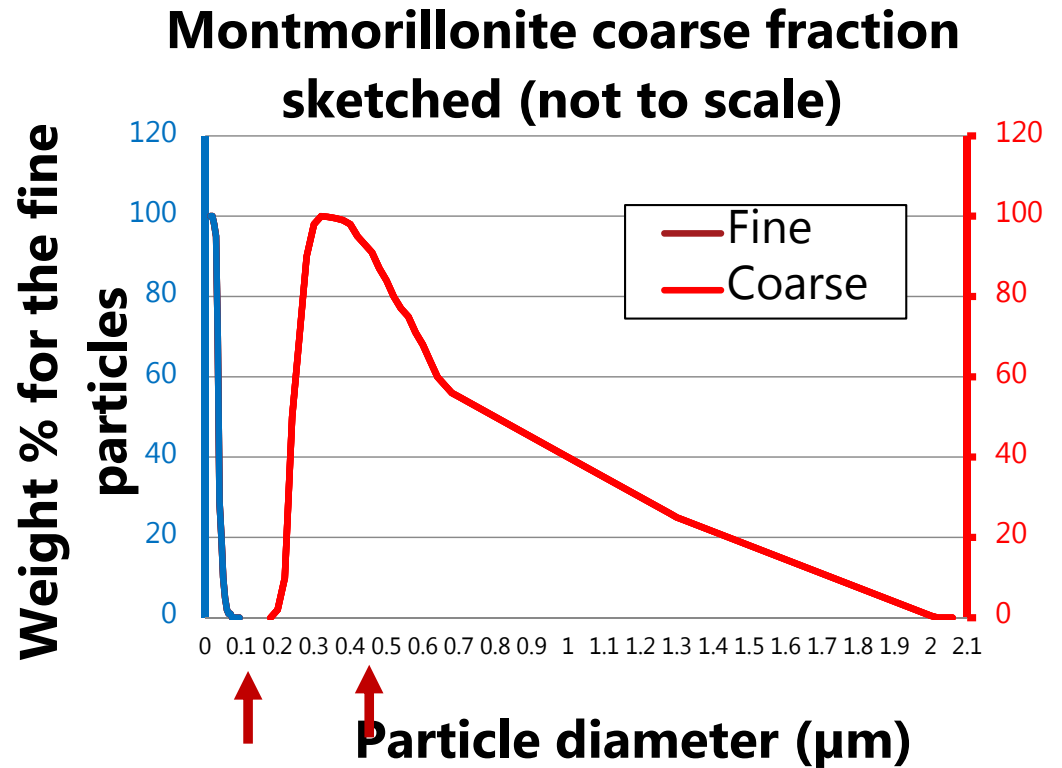
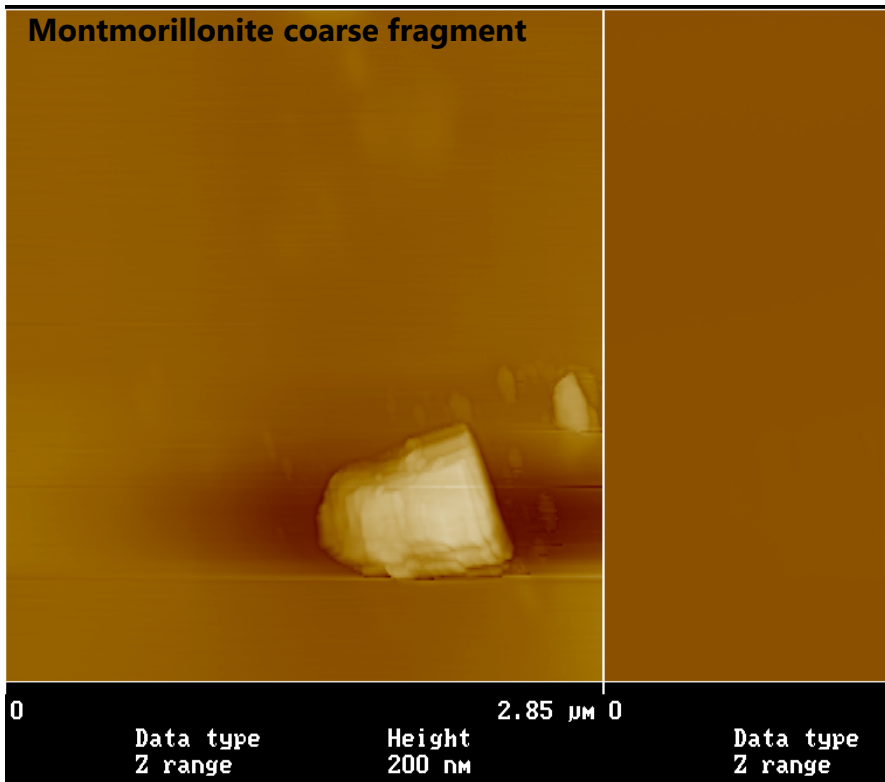
200 - 2000 nm coarse clay

**Montmorillonite coarse fraction in 3 replicates
20 - 500 nm (high resolution)**



200 - 2000 nm coarse clay

Particle properties for pyrethroids sorption

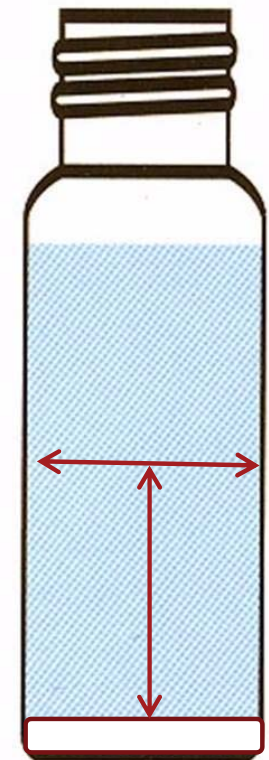


Coarse particles can be sedimented by ultra-centrifugation
 Fine clay particles (<100 nm) stay suspended after ultra-centrifugation

The challenges of hydrophobic compounds in sorption studies

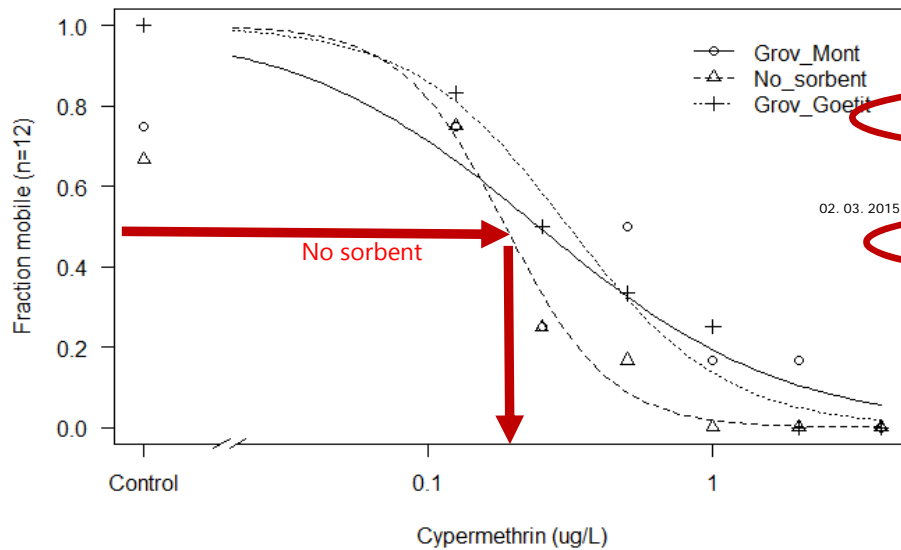
- How to control the cypermethrin concentration?
 - A source of cypermethrin which can counteract sorption is needed
 - Water concentrations are controlled by an equilibrium
 - Silicone has a high affinity for hydrophobic compounds
 - High loading with cypermethrin is needed

$$K_d = \frac{C_{\text{silicone}} \left[\frac{\mu\text{g}}{\text{kg}} \right]}{C_{\text{softwater}} \left[\frac{\mu\text{g}}{\text{L}} \right]} = \left[\frac{\text{L}}{\text{kg}} \right]$$



Ecotox effects of particle-associated pyrethroids

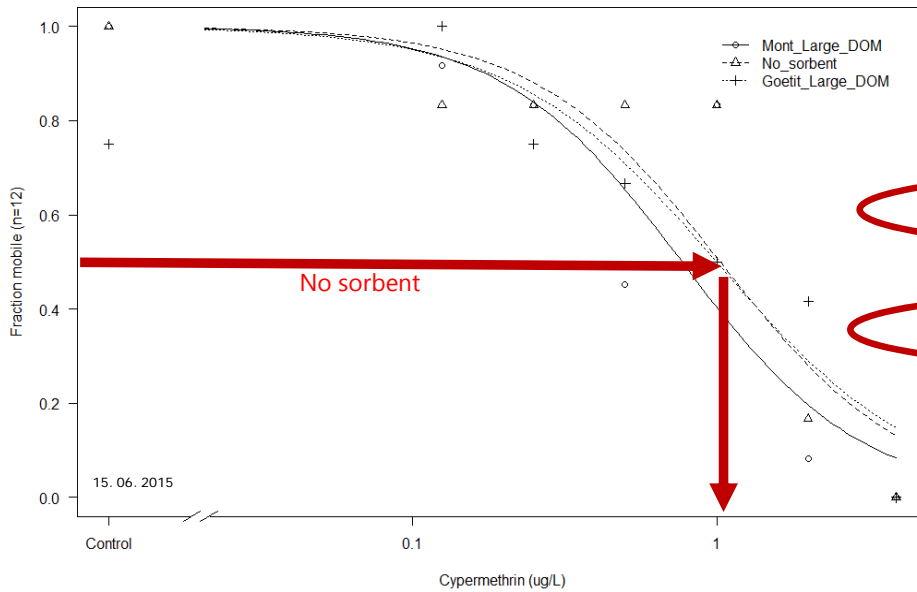
- Toxicity of sorbed and dissolved pyrethroids (4×3 fractions from 1A) to *G. pulex* (pulse exposure)



Treatment	M_coars (mg/l)	M_fine (mg/l)	G_coars (mg/l)	OM (mg C/l)
Coarse montmorillonite	25			
Coarse montmorillonite + NOM	25			0.21
Coarse goethite			25	
Coarse goethite + NOM			25	0.21
Fine montmorillonite		5		
Fine montmorillonite + NOM		5		0.21
Organic matter				0.21
Coarse montmorillonite + NOM	25			5
Coarse goethite + NOM			25	5

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