

Bioavailability and uptake of antimony,
cadmium and cobalt in dragonfly larvae
(Odonata, Anisoptera) as a function of
road salt concentrations

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Road run off

- Mitigation measures: Sedimentation ponds
 - High concentrations of contaminants
 - Becomes natural habitat for many organisms



- Natural lakes and ponds close to roads

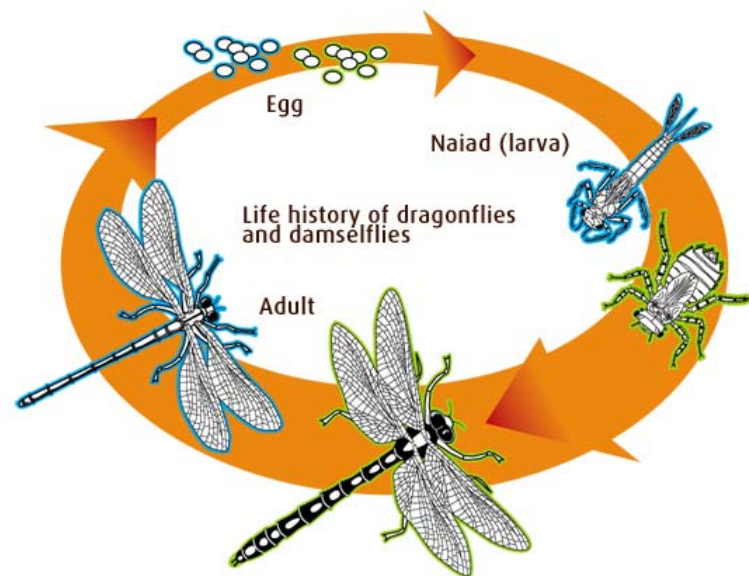
Road run off - contaminants

- Vehicles
 - Brakes (Ba, Cu, Fe, Pb, Sb)
 - Tires (Al, Cd, Co, Pb, W)
 - Body (Cr, Fe, Zn)
 - Combustion (Cd, Co, Sb, PAH)
 - Oil spill (PAH)
- Other sources
 - Road surface (asphalt) (metals, PAH)
 - De icing chemicals (Na, Cl, Ca, Mg)
 - Detergents (tensides)



Odonata

- Abundant and important members in a variety of freshwater ecosystems
- Predators of invertebrates and vertebrates larvae
- Important prey base for aquatic and terrestrial predators
- Insecticides much studied, but not metal contaminants



Objectives

- Investigate toxicokinetics of Cd, Co and Sb in odonata larvae exposed to spiked sediments, using radioactive tracer technique
- Investigate how addition of road salt affects the bioaccumulation of Cd, Co and Sb



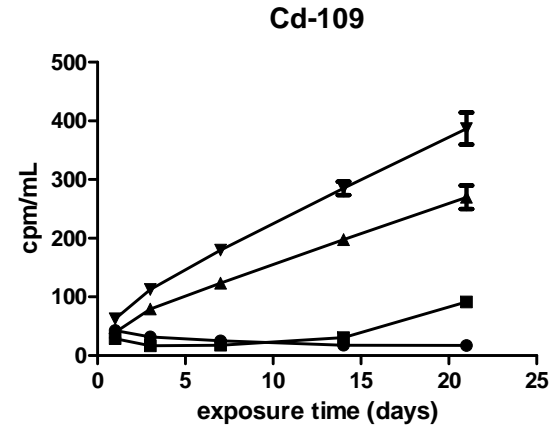
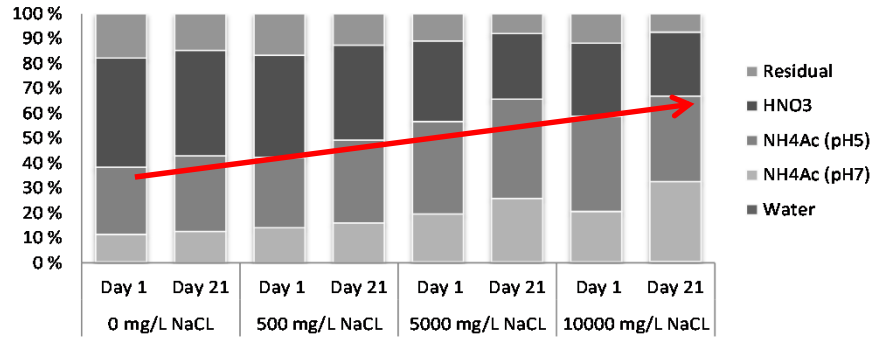
Experimental design

- Exposure:
 - Sediment spiked with Cd-109, Co-60 and Sb-125
 - Road salt
- Odonata larvae collected in ponds
- Each beaker housing one larvae
- Time dependent accumulation (21 days)
- Excretion (14 days)
- Mobility; sequential extraction and K_d

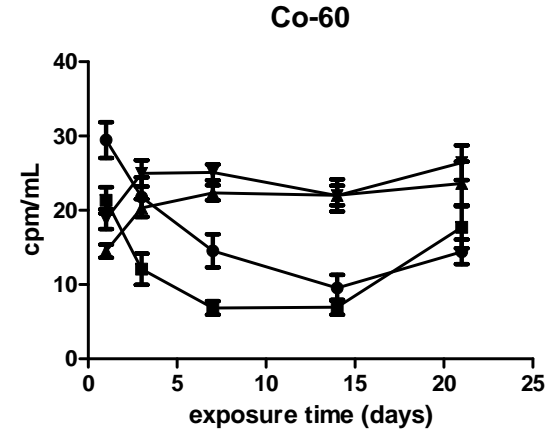
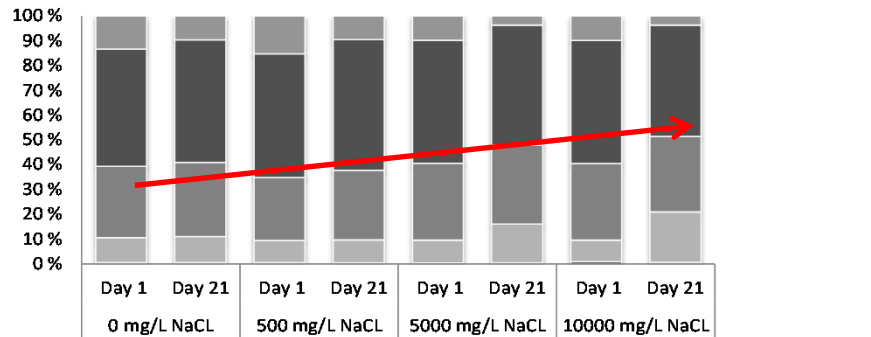


Mobility of ^{109}Cd , ^{60}Co and ^{125}Sb

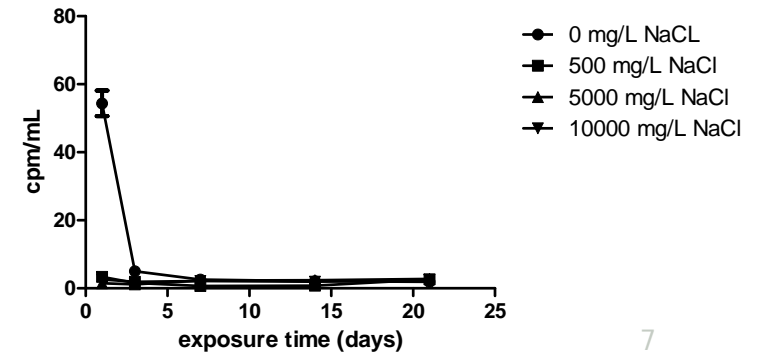
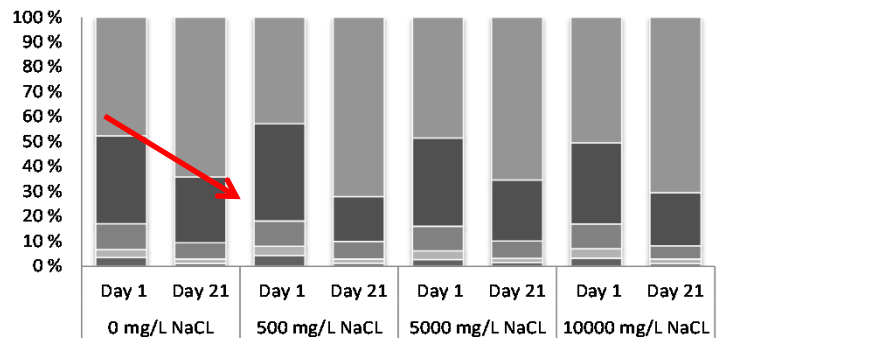
Cd-109



Co-60



Sb-125



Distribution coefficients (Kd)

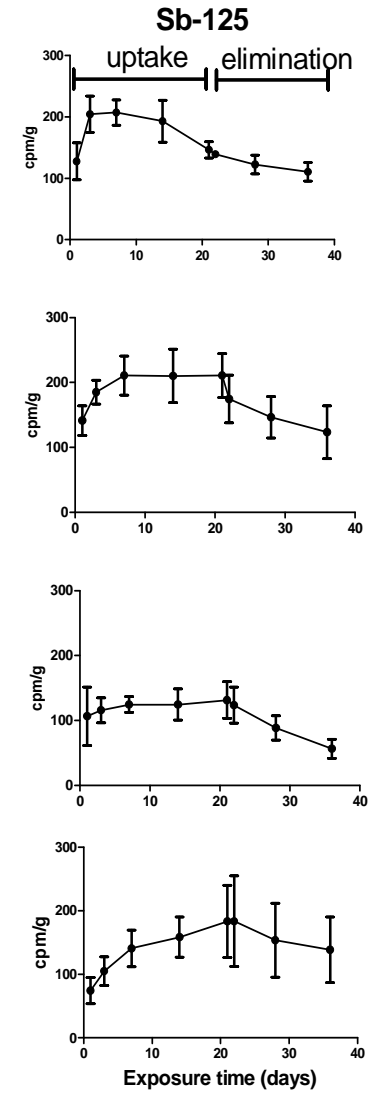
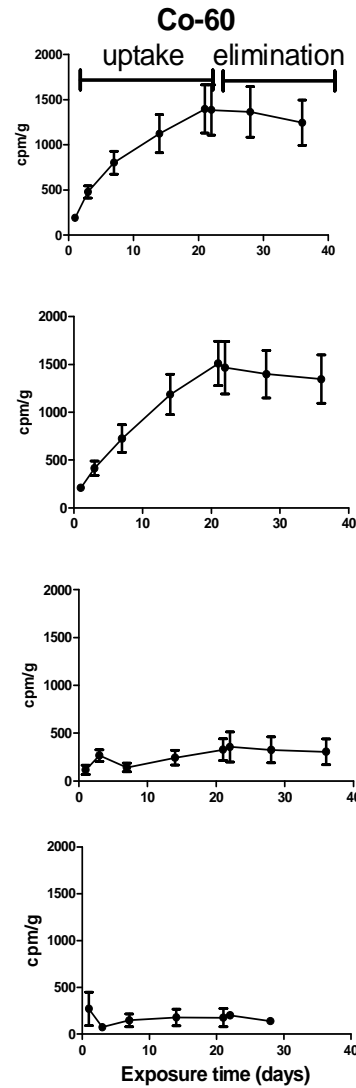
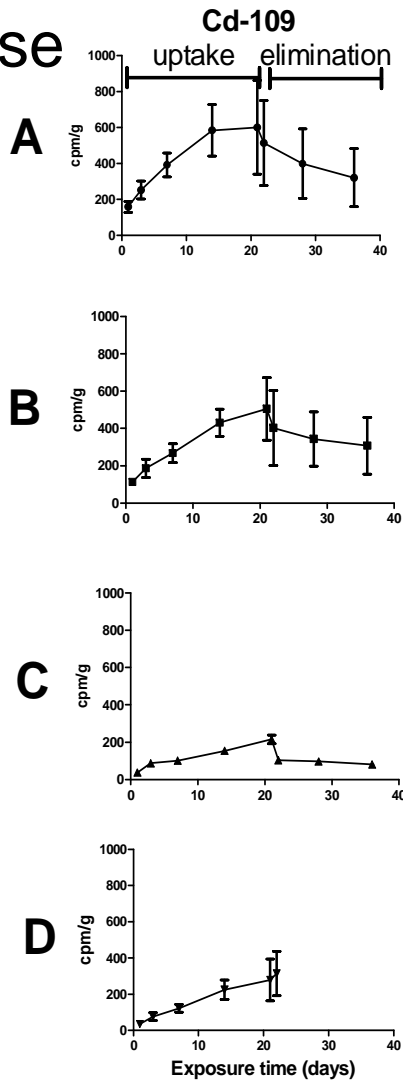
	NaCl (mg/L)	Kd Day 1	Kd Day21
¹⁰⁹ Cd	0	128	300
	500	183	55
	5000	124	18
	10000	79	13
⁶⁰ Co	0	70	140
	500	90	109
	5000	120	72
	10000	102	73
¹²⁵ Sb	0	28	30
	500	44	129
	5000	166	54
	10000	148	60

- Cd and Co;
 - No salt -> Kd increase with time
 - Salt -> Kd decrease
- Sb
 - No salt -> Kd stable
 - More salt -> Kd increase

Bioaccumulation in larvae



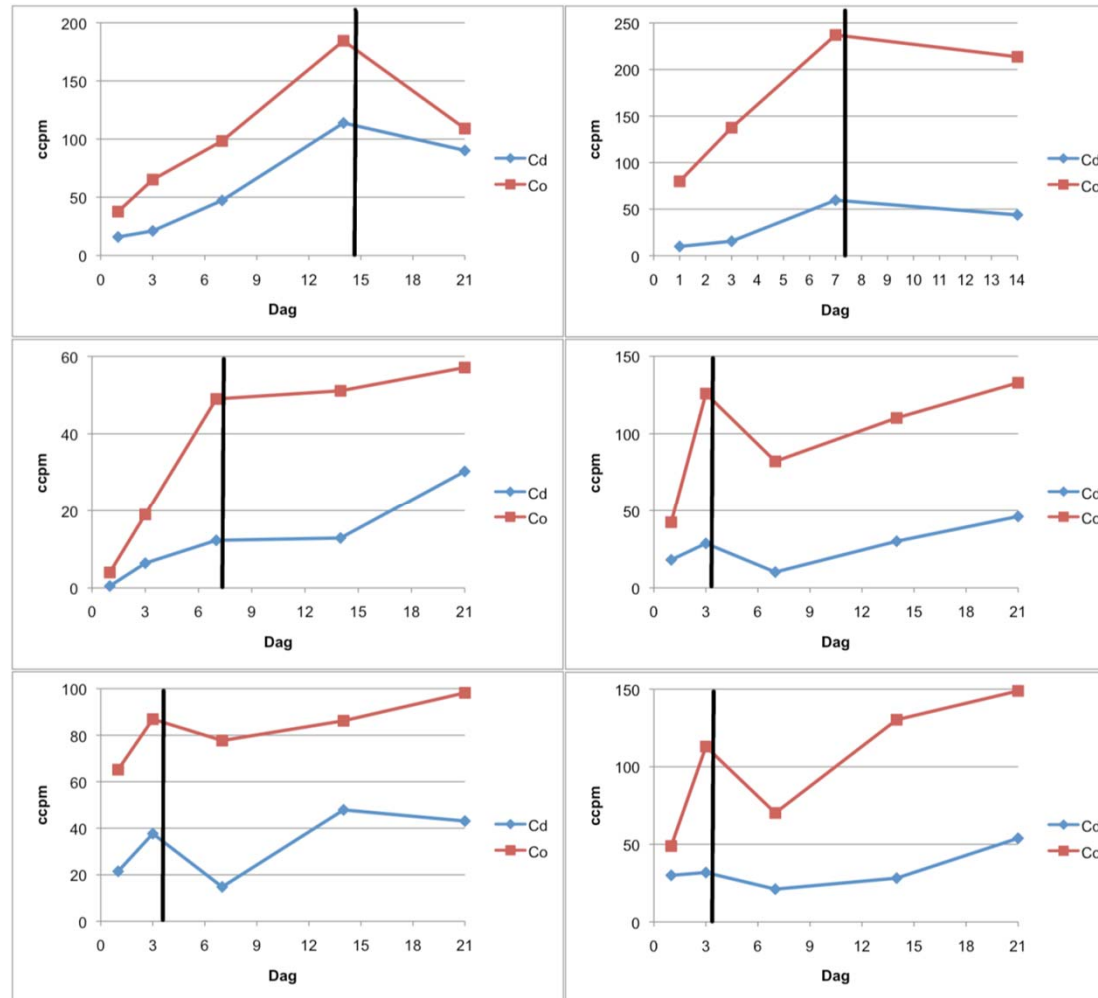
Increase
 NaCl



Digital autoradiography



Change of exoskeleton (molting)



Conclusions

- Cd and Co were less strongly bound than Sb in sediments
- Addition of salt increased mobility of Cd and Co, but not Sb
- Bioaccumulation without salt; $Co > Cd >> Sb$
- Addition of salt; decreased bioaccumulation of Co and Cd
- Road salt affects binding and mobility of metals in sedimentation ponds
- Increased mobility of metals does not need to be a risk of increased bioaccumulation for some elements



Thank you for your attention !

