

Using the concept of chemical activity to assess mixture toxicity in *Daphnia magna*

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BACKGROUND

- It is challenging to measure environmental concentrations of all chemical mixtures
- Concentrations cannot be added up to inform about mixture toxicity, as toxicity-exerting concentrations are compound specific
- The chemical activity approach may provide a concept to address the toxicity of chemical mixtures by converting the concentration of each chemical into a common, additive currency that relates to baseline toxicity^{1,2}
- Chemical activity (a) is calculated as:

$$a = \frac{C}{S}$$

where C is the chemical concentration [mol m⁻³] and S is the solubility [mol m⁻³] of the soluble compound in water³

HYPOTHESIS

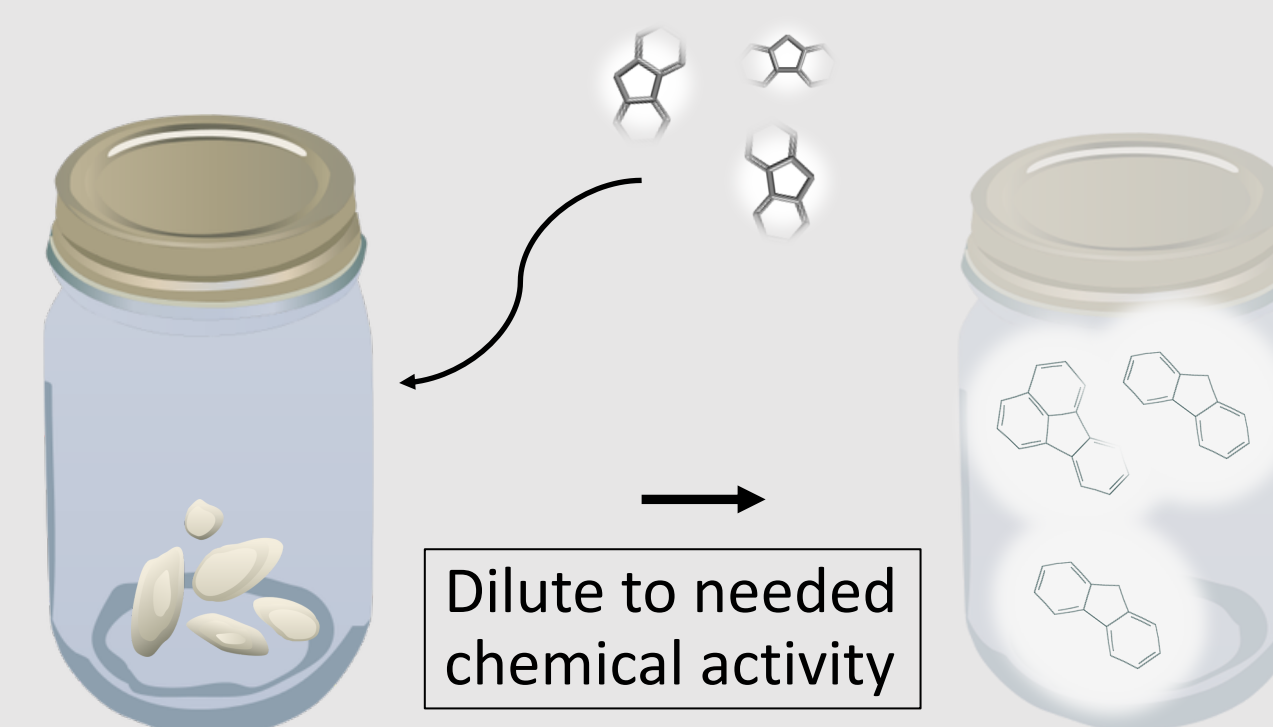
Chemical mixtures with different composition but the same chemical activity show the same toxic effect on the model organism *Daphnia magna*.

OBJECTIVES

- To apply the concept of chemical activity and mixture toxicity on *Daphnia magna*
- To investigate whether sum chemical activity explains the combined toxicity to *Daphnia magna* of mixtures composed of different chemical classes

METHODS

Saturated methanol solution:



- The concentration of each chemical compound stays low
- To stay below any known threshold for specific toxicity, mixtures will not exceed a = 0.1

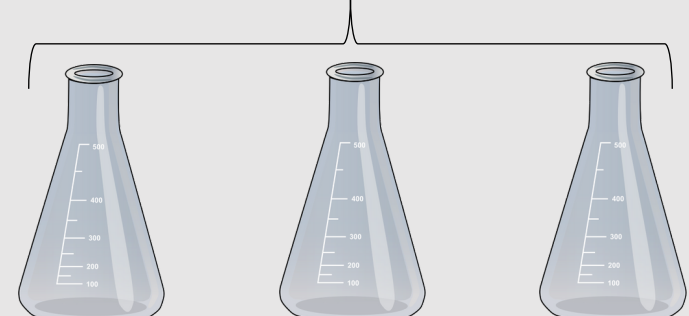
Passive dosing via silicone rods:

- a = 0.0 blank
- a = <0.1 PCB mixture
- a = <0.1 PAH mixture
- a = <0.1 n-alkanes mixture

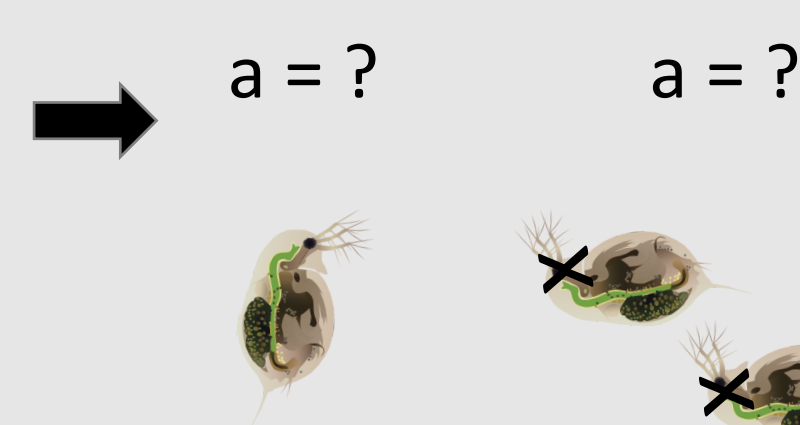


FUTURE WORK

Preparation of several chemical mixtures below specific toxicity from saturated methanol solutions
a = 0.01; a = 0.05; a = 0.1



Stable exposure to chemicals using silicone rods to maintain the same relative mixture composition



a) Preparation of chemical mixtures in different chemical activities and different composition

b) Exposure of *Daphnia magna* to chemical activities via passive dosing

c) Hypothesis: Toxic effects are a function of chemical activity and not of mixture composition

ACKNOWLEDGEMENTS

This project has received funding from the EU Horizon 2020 program under the Marie Skłodowska-Curie grant agreement GA-813124.

LITERATURE

- ¹ Gobas et al., *Environmental toxicology and chemistry* 37.5: 1235-1251 (2018)
 - ² Schwarzenbach et al., *Environ. Organic Chemistry* John Wiley & Sons, (2003)
 - ³ Gobas et al., *Environmental toxicology and chemistry* 34.12: 2723-2731 (2015)
- Symbols for diagrams courtesy of the Integration and Application Network (ian.umces.edu/symbols)

THE AUTHOR

PhD student/Early Stage Researcher within the Marie Skłodowska-Curie Innovative Training Network project ECORISK2050
To learn more about ECORISK2050 see poster 7.03PC.1 or the QR code sabrina.roth@aces.su.se

