

## CROSS-VALIDATION FOR IMPROVING DETERMINATIONS OF WATER SOLUBILITY FOR DIFFICULT TO TEST SUBSTANCES

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### Background

#### Water solubility

- A fundamental parameter for environmental risk assessment
- Important input parameter in exposure and fate models
- Sets upper concentration limit in aqueous toxicity testing
- Sets upper limit for concentration gradients driving diffusion

#### Aims

- Scientific and technical progress in solubility testing of poorly soluble substances and UVCBs
- Contributions to an update of the OECD 105 guideline
- Cross-validation to increase confidence in solubility data
- Knowledge gain from ring testing and explorative research

### Water solubility challenges

#### Technical challenges

- Establish and maintain concentrations exactly at solubility
- Ensure absence of pure substance (liquid or crystal)
- Ensure absence of substance bound to a third phase

#### Analytical challenges

- Measure low concentrations in small water volumes
- Good alignment of solubility experiments and subsequent analytical measurements

#### Scientific challenges

- Solubility for UVCBs and isomeric/enantiomeric mixtures?
- Solubility for surfactants?

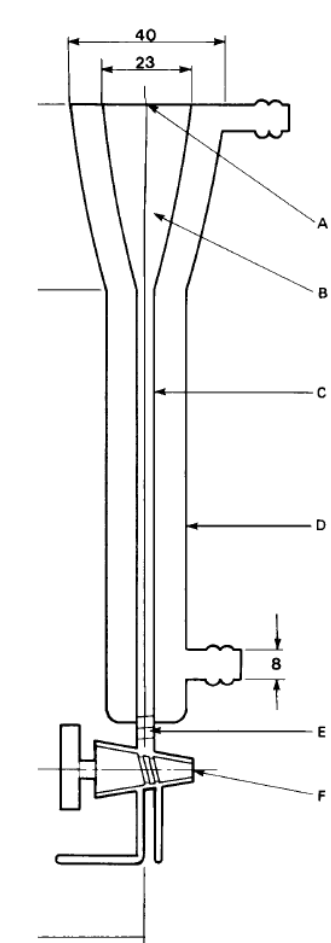
### Ring testing for solids and volatile liquids

#### Slow-stir method



(Letinski et al., 2016)

#### Column elution method



(OECD 105)

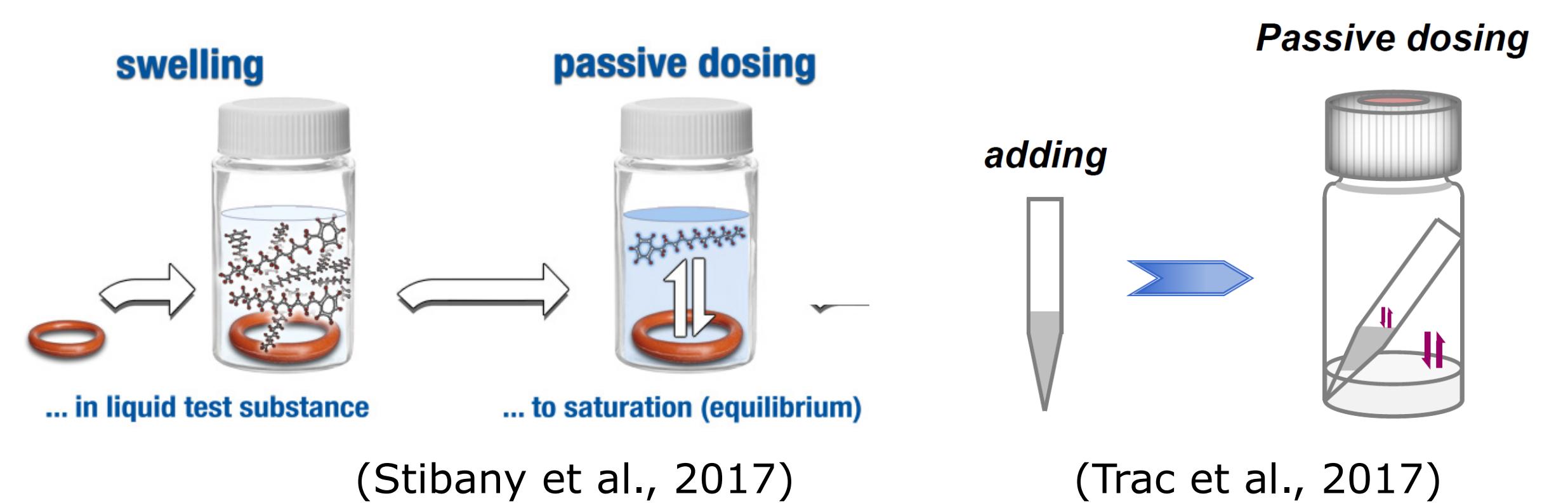
### New approaches for liquid hydrophobics

Avoid direct contact between pure substance and water

#### Passive dosing at and just below saturation

I) from saturated silicone

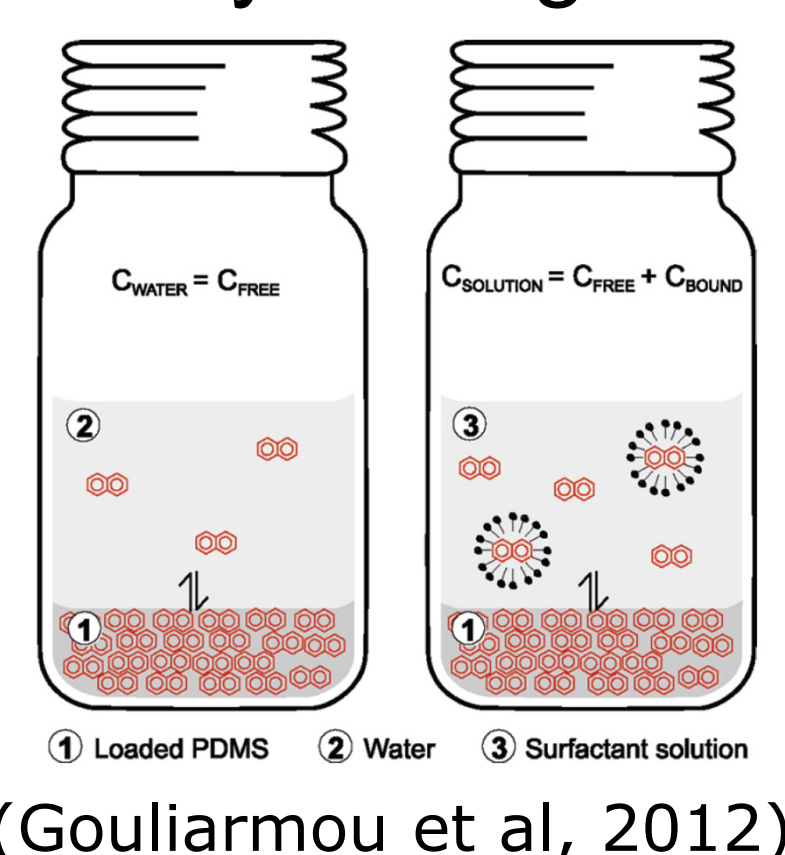
II) via headspace



### Quantification of medium effects on solubility

Solubility depends on media composition

Medium effects on solubility will be determined in 5 environmental and toxicity testing media



### Solubility of mixtures

Solubility is well defined for pure substances

Solubility information is also needed for:

- Isomeric and enantiomeric mixtures
- Products of unknown or variable composition (UVCBs)

How can solubility for mixtures be defined, in terms of level and composition?

How can passive dosing be adapted and optimized to measure such solubility parameters?

Gouliarmou, V., Smith, K.E.C., de Jonge, L.W. and Mayer, P. 2012. Measuring speciation of hydrophobic organic chemicals at controlled freely dissolved concentrations without phase separation. Analytical Chemistry 84, 1601–1608.  
Letinski, D.J., Parkerton, T.F., Redman, A.D., Connelly, M.J. and Peterson, B. 2016. Water solubility of selected C9-C18 alkanes using a slow-stir technique: Comparison to structure - property models. Chemosphere 150: 416-423.  
Stibany, F., Schmidt, S.N., Schäffer, A. and Mayer, P. 2017. Aquatic toxicity testing of liquid hydrophobic organic chemicals – passive dosing exactly at the saturation limit. Chemosphere 167: 551-558.  
Trac, L.N., Schmidt, S.N. and Mayer, P. 2017. Headspace Passive Dosing – aquatic toxicity testing of liquid chemicals with high Henry's constants exactly at their saturation limit. SETAC Europe 27th Annual Meeting, Brussels, Belgium, 7–11 May 2017