

# **Equilibrium Passive Sampling for Short-term Measurements of PCBs in Surface Water**

6.04.P-We-162

(Log Kow=7.1)

Average short-term storm

average long-term velocity.

PCB concentration in LBC

water velocity ~ 16X

not diluted by high

discharge

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### **INTRODUCTION**

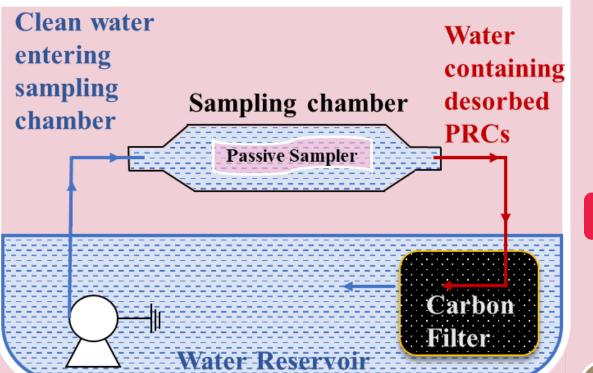
- Passive sampling has been extensively explored for long-term integrated measurements; useful in ecological risk assessment.
- **Short-term measurements (1-2 days)** are needed to assess impacts from episodic events like storm flows into surface water.
- Equilibrium passive sampling has not been explored for short-term measurements in water.

### **OBJECTIVE**

Optimizing equilibrium passive samplers (LDPE sheet and PDMS coated SPME fibers) for short-term measurements of PCBs in surface water.

### **APPROACH**

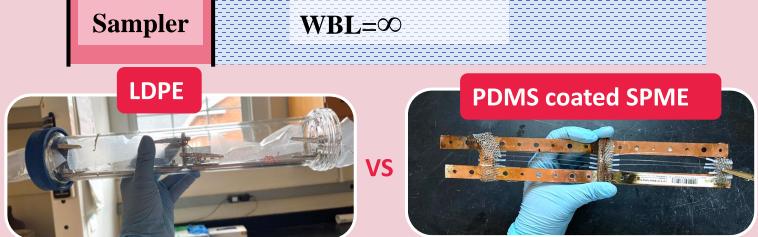
#### **ARTIFICIAL FLOW CHAMBER (AFC)**



River-like FLOW conditions (water velocity: 5-30 cm/s) inside actual sampling chamber



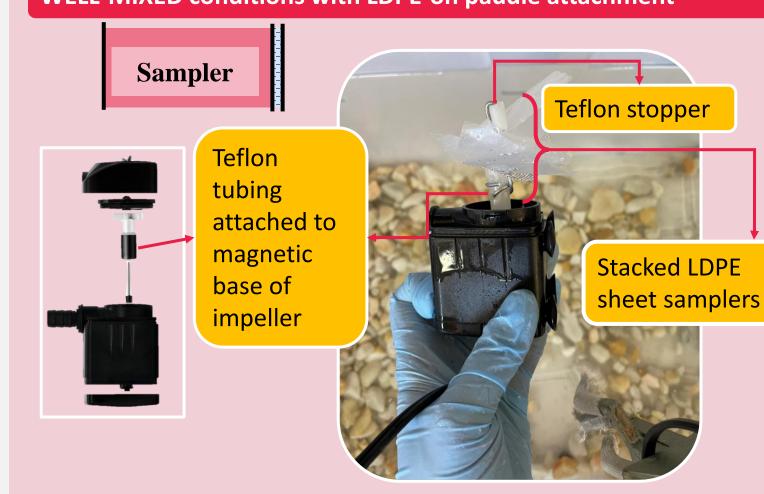
Pond-like UNMIXED conditions inside water reservoir



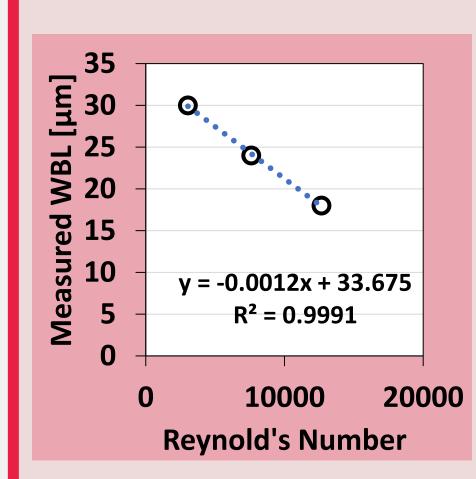
Thin sheet sampling device for FIELD APPLICATIONS



# WELL-MIXED conditions with LDPE-on paddle attachment



# Laboratory-scale design optimization **RESULTS** PRC 54 [1 day exposure] ■ PE\_25um ■ PDMS\_38um Flow 6cm/s Flow 15cms Flow 25cm/s Exchange kinetics in 25µm PE faster than 38µm PDMS in Stagnant and Flow conditions **PRC 54 —**WBL=0 μm **—**WBL = 10 μm **—**WBL = 20 μm **-**WBL = 30 μm 8.0 & **—**WBL = 50 μm **—**WBL = 500 μm 0.6 <u>e</u> -WBL=10^5 μm **X** Unmixed ♦ Flow 6cm/s ☐ Flow 15cm/s ▲ Flow 25 cm/s O 25umPE on Paddle ⊃ 18umPE on Paddle Fr Time [Hours]



- Reynold's Number

   calculated corresponding to
   water velocities 6, 15, 25
   cm/s.
- WBL thickness estimated from model fitting of measured fractional loss of PRCs
- Correlation is unique for a non-rigid sheet sampler like PE.

#### RESULTS Field application of optimized sampling device 0.80 Deca **Short-Term (<2 Days)** Nona (7/gu) ■ LBC1\_Short Octa Hepta LBM1\_Short Hexa Penta Tetra long short short long Di PRC PRC PRC PRC ARX2 LBC1 LBM ARLB 37 111 138 178 **Sampling Times: Short-term:** 12 Oct -14 Oct 2022 (43 hours) • PRC loss: 40% PRC 54 (Log Long-term: Sept-Dec, 2021 (4 months) Kow = 5.2) - 5.5% PRC 178

## CONCLUSIONS

- Short-term passive sampling is possible within 1-2 days in high flow conditions using thin PE samplers.
- Field deployment of optimized passive samplers demonstrates the feasibility of short-term sampling during storm flow .
- Paddle attachment can be used for short-term measurement in baseflow conditions.

Lower Beaverdam

• Correlation between WBL and Re can be used to estimate anticipated equilibrium within short sampling times before field application, to make informed decision about sampler choice.

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