Bioconcentration of anionic surfactants in fish

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Objective

- To determine the BCFs of a range of anionic surfactants in order to evaluate a predictive model of ionic chemical bioaccumulation in fish (BIONIC)

Methods

Table 1. Experimental conditions of exposure

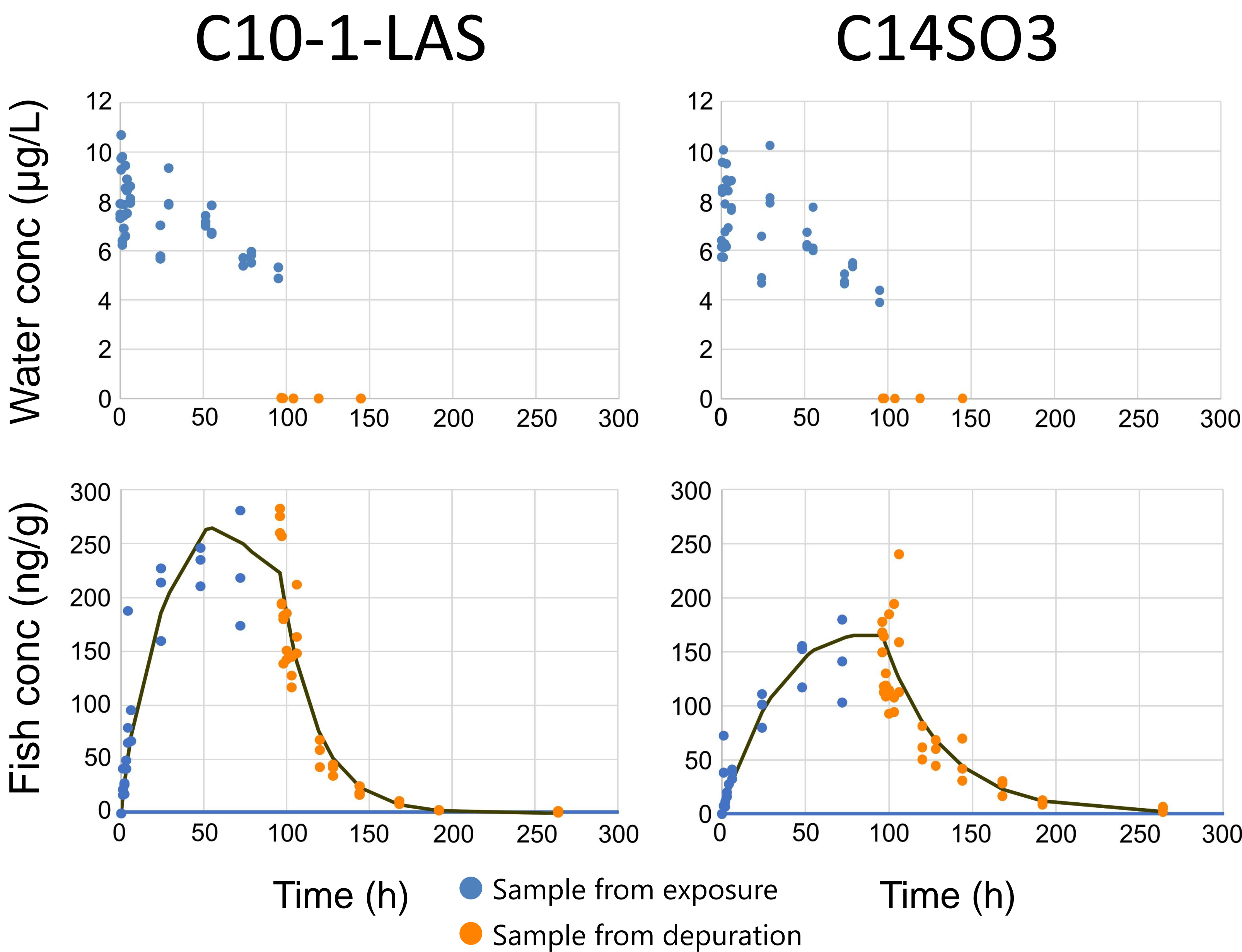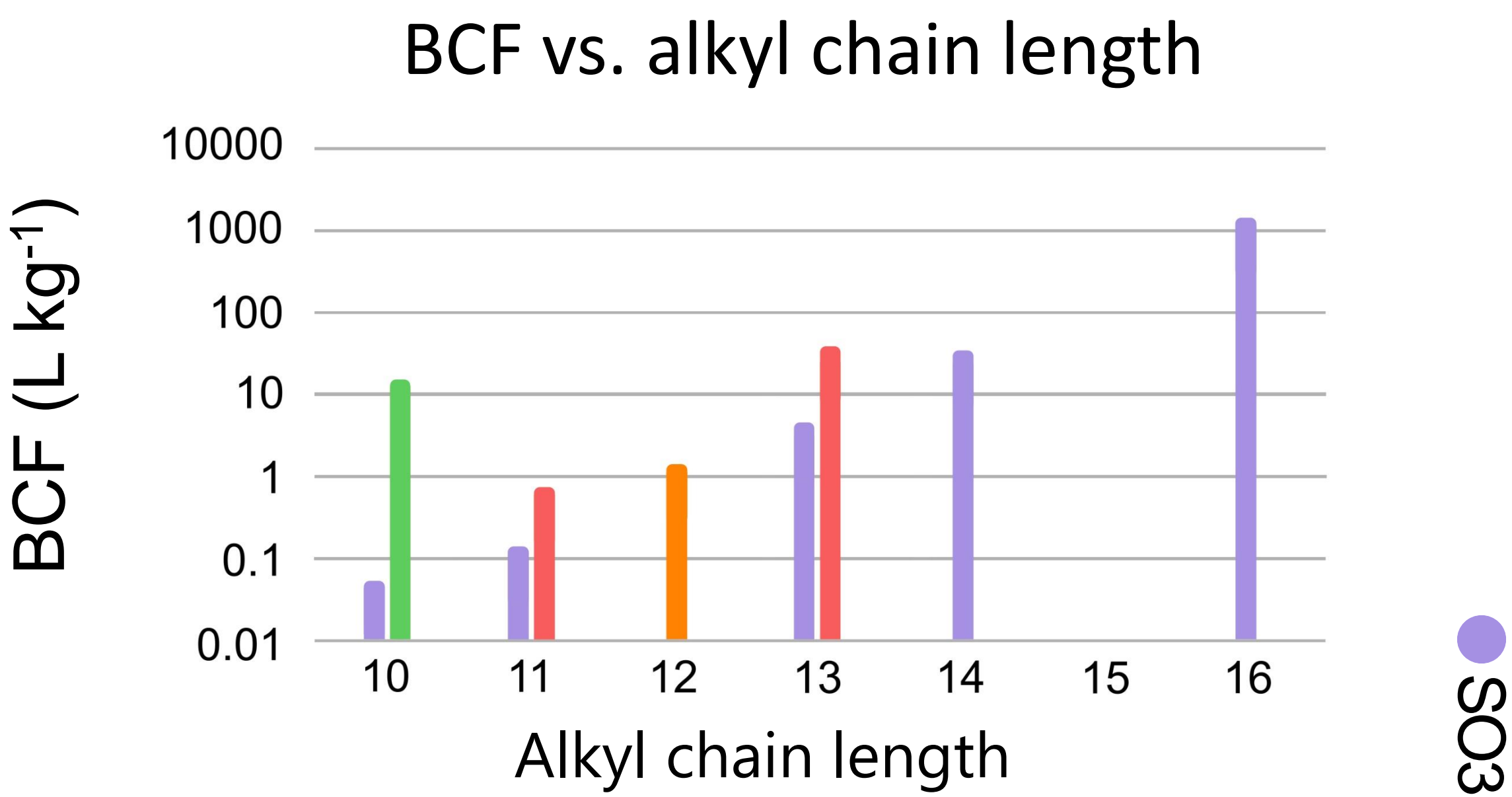| Species	Rainbow Trout (*Oncorhynchus mykiss*)
Average weight	24.0 ± 5.6 g
Light regime	12 h cycles
Length of exposure phase	96 h
Length of elimination phase	168 h
Water: No. sampling points (replicates per point)	21 (3)
Fish: No. sampling points (replicates per point)	19 (3)
Aquarium volume; Flow through rate	300 L ; 1.5 L/min
Chemical delivery solvent; Solvent conc. (v/v %)	MeOH ; 0.0004 %
Water temperature	10°C

- Water analysis: Addition of MeOH and IS to tank water and injected on C18 coupled LC-MS/MS.
- Fish analysis: Homogenized with beads after addition of MeOH and int. std., sonicated and centrifuged. Extract was then direct injected on the C18 coupled LC-MS/MS used for water analysis.

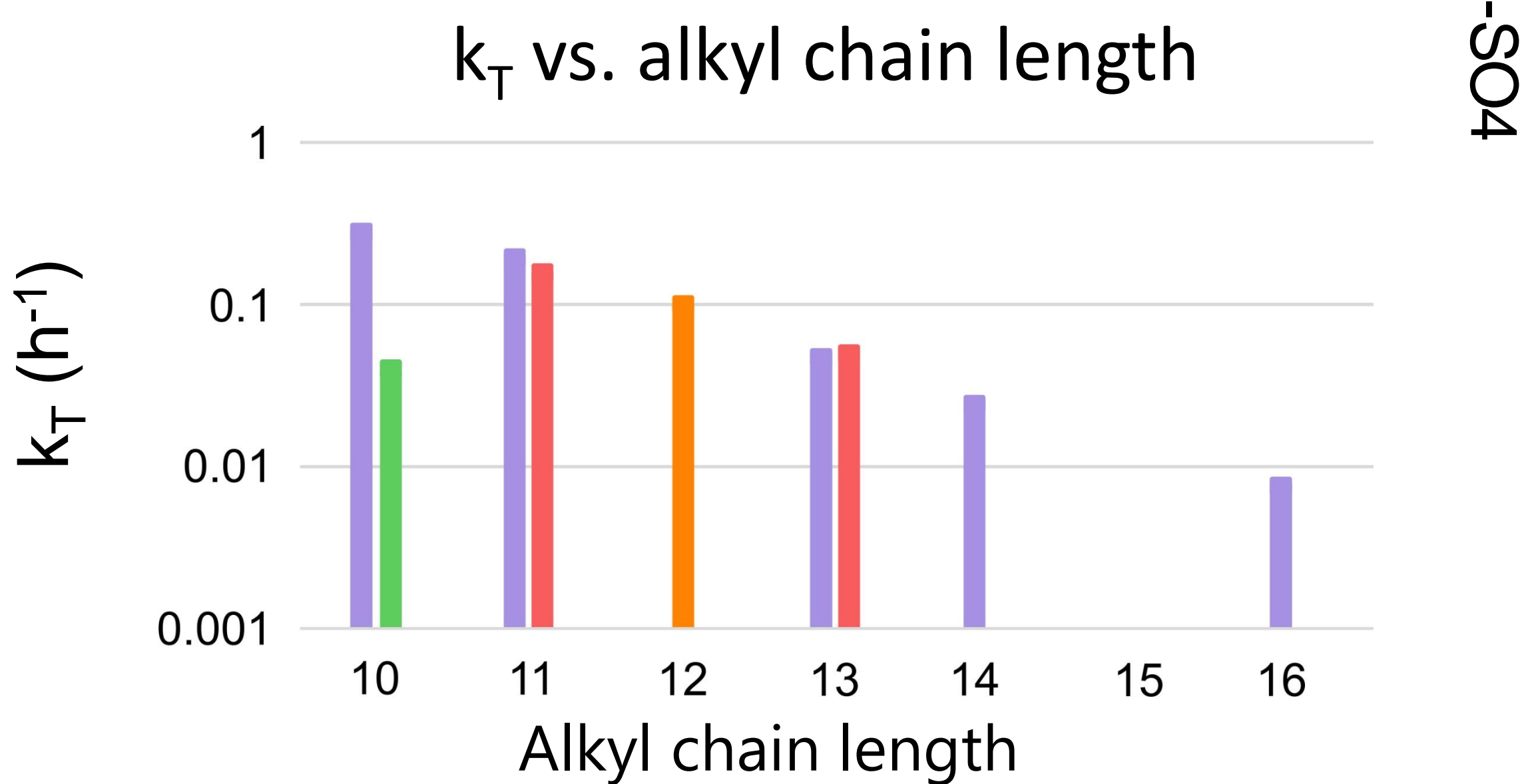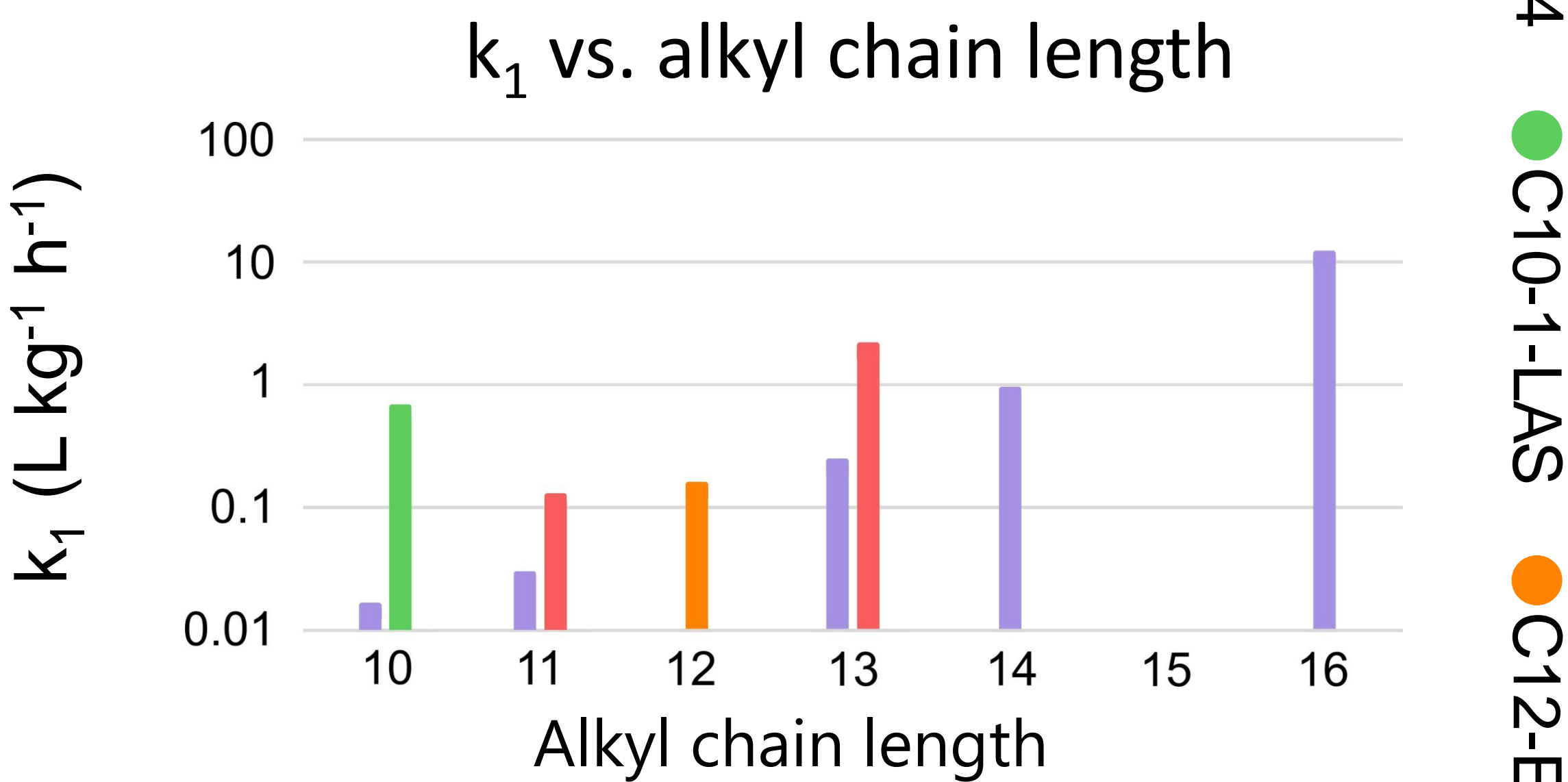Table 2. Chemicals present in exposure mixture

Chemical	Avg. exposure conc. (µg/L)
C10SO3	59.5
C11SO3	40.9
C13SO3	5.8
C14SO3	6.8
C16SO3	6.1
C11SO4	20.4
C13SO4	9.5
C10-1-LAS	7.4
C12-EO4-SO4	41.3
DOSS	57.6
BEHP	59.1

Results

Water & fish concentrations

C10-1-LAS, C14SO3 — Water conc (µg/L) and Fish conc (ng/g) vs. Time (h). Sample from exposure (blue), Sample from depuration (orange).

Bioconcentration factors

BCF vs. alkyl chain length — BCF (L kg⁻¹) vs. Alkyl chain length.

Kinetic rate constants

k_1 vs. alkyl chain length — k_1 (L kg⁻¹ h⁻¹) vs. Alkyl chain length.

k_T vs. alkyl chain length — k_T (h⁻¹) vs. Alkyl chain length.

Legend: SO3, SO4, C10-1-LAS, C12-EO4-SO4

Conclusions

- BCF for SO3 increases by 0.75 log unit per CH_2 group.
- Both k_1 and k_T contribute to this chain length dependence.
- SO4 BCF 0.75 log units greater than for SO3 of same length.
- EO4-SO4 has similar BCF to SO3 of same chain length.
- LAS BCF 2.5 log units greater than for SO3 of same length.