

Measuring bioconcentration of cationic surfactants in fish

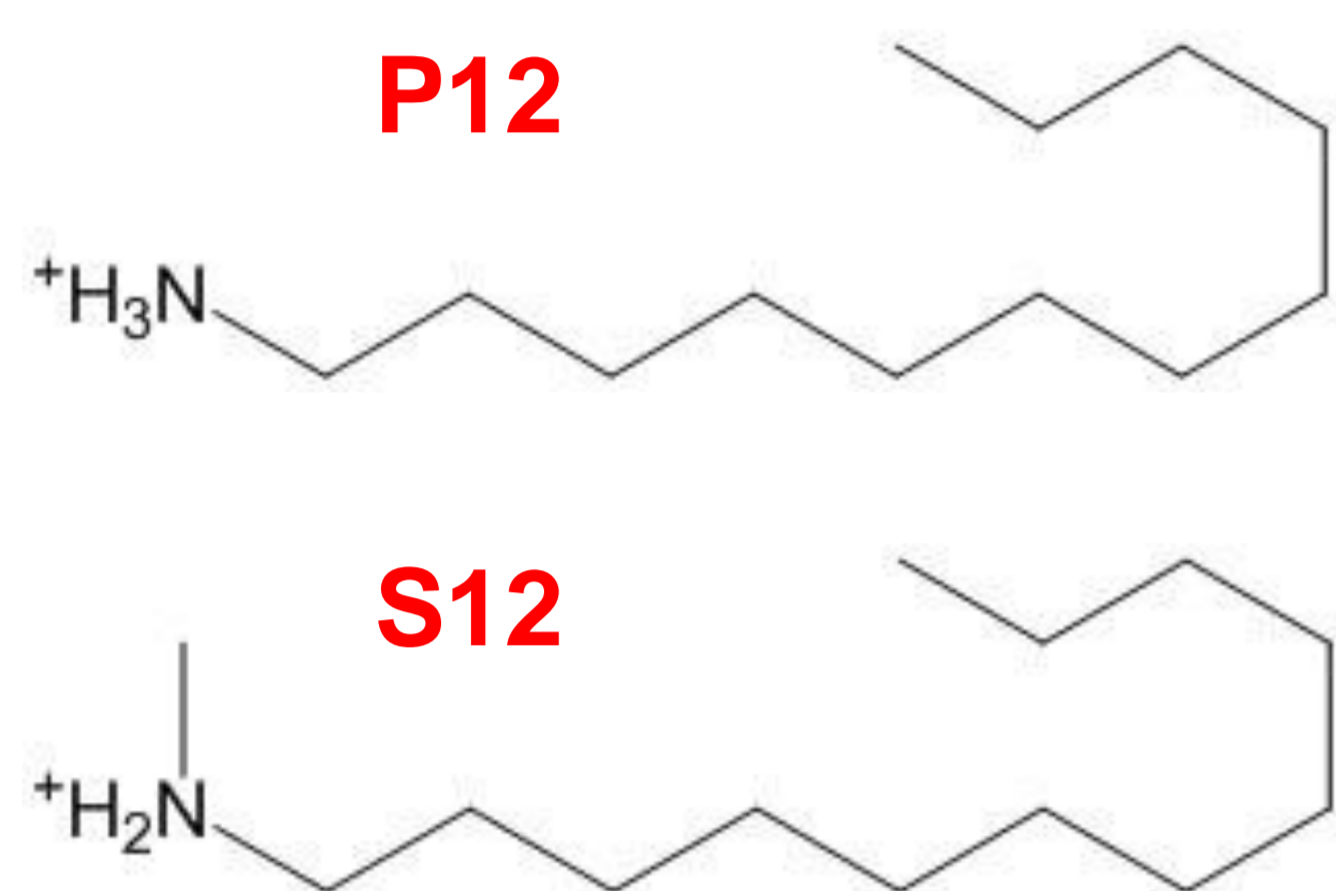
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Introduction

Measuring the bioaccumulation of cationic surfactants in fish is challenging, and there are few measurements in the literature. Many cationic surfactants sorb extensively to surfaces, making it difficult to generate and maintain constant concentrations in aquarium water. They can also sorb extensively to the surface of fish, making it difficult to separate internal exposure from external exposure. They display a partitioning behaviour that is similar to biomolecules, making it challenging to separate them from major matrix components in fish tissue samples.

We are currently working to define the cationic surfactant property space that is amenable to measurement of bioconcentration factors in fish. Here we report on the distribution of a homologue series of cationic surfactants between different tissues in fish. We exposed rainbow trout to alkyl amines for 1 week, sacrificed the fish and analyzed muscle, liver, gills, skin and the mucus on the skin for the target chemicals. The study was conducted under permit 9967/2017 of Stockholms djurförsöksetiska nämnd.

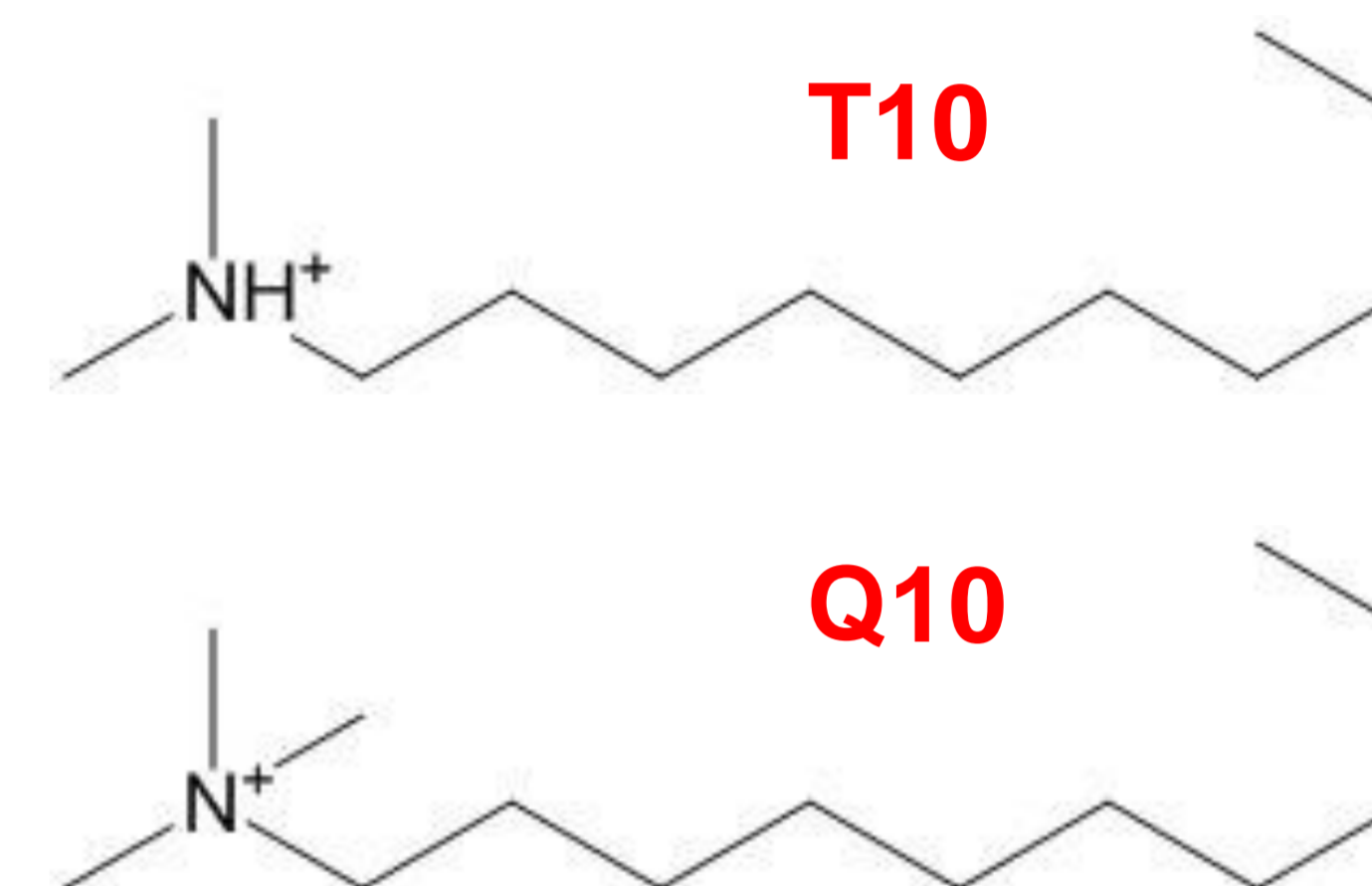


Results and Discussion

QA/QC

Blanks: chemical quantity in the most contaminated blank was at least 5 times lower than the mean quantity in the sample except for Q10 and Q14 in muscle, liver and skin. Therefore no data reported for Q10 and Q14.

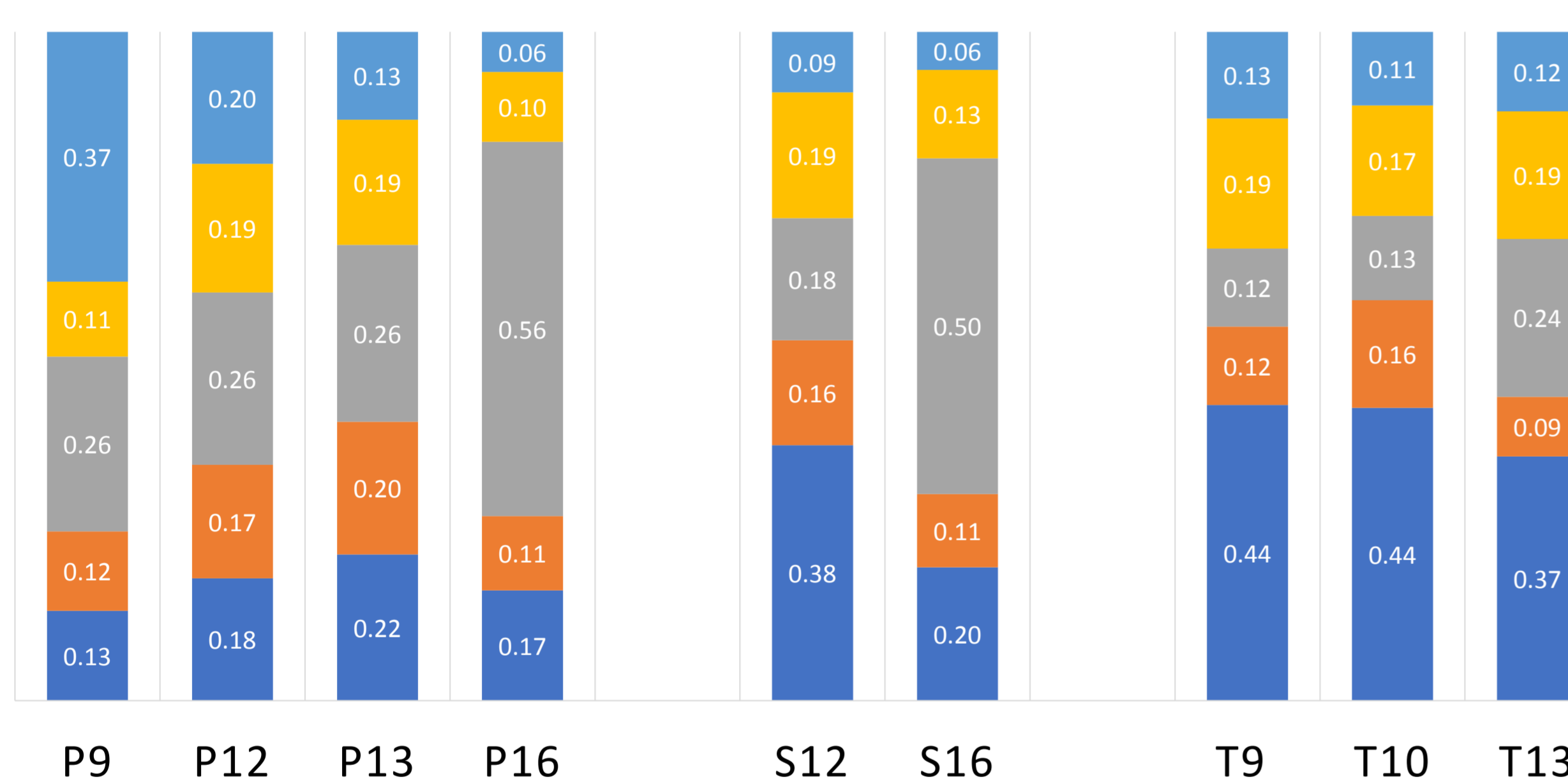
Precision: 1-4% in liver, 2-12% in muscle (RSD from triplicate analyses)



Each tissue contributes significantly to the body burden
(at least 20% for one chemical)

TISSUE DISTRIBUTION (mean of 6 fish)

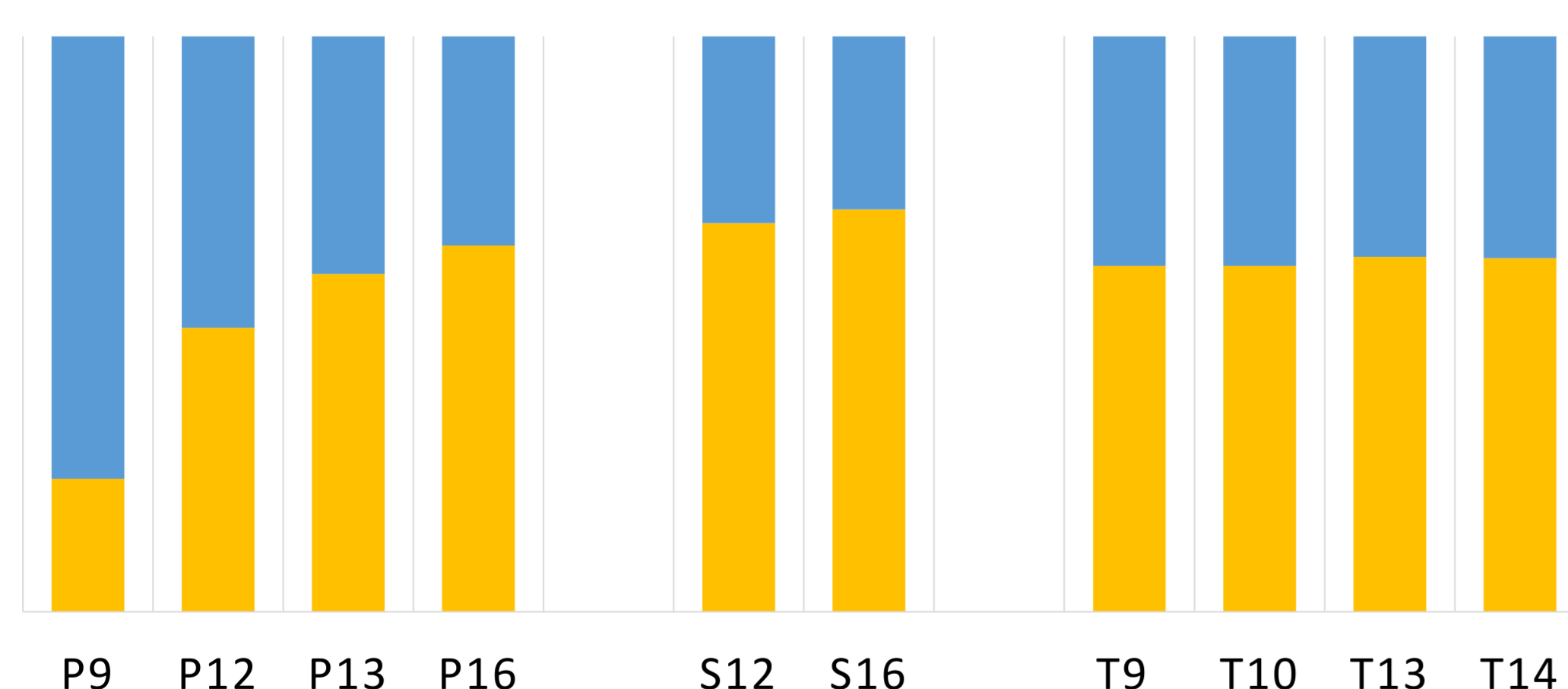
■ Muscle ■ Liver ■ Gills ■ Skin ■ Mucus



Less than half of surfactant associated with skin removed by rinsing with methanol

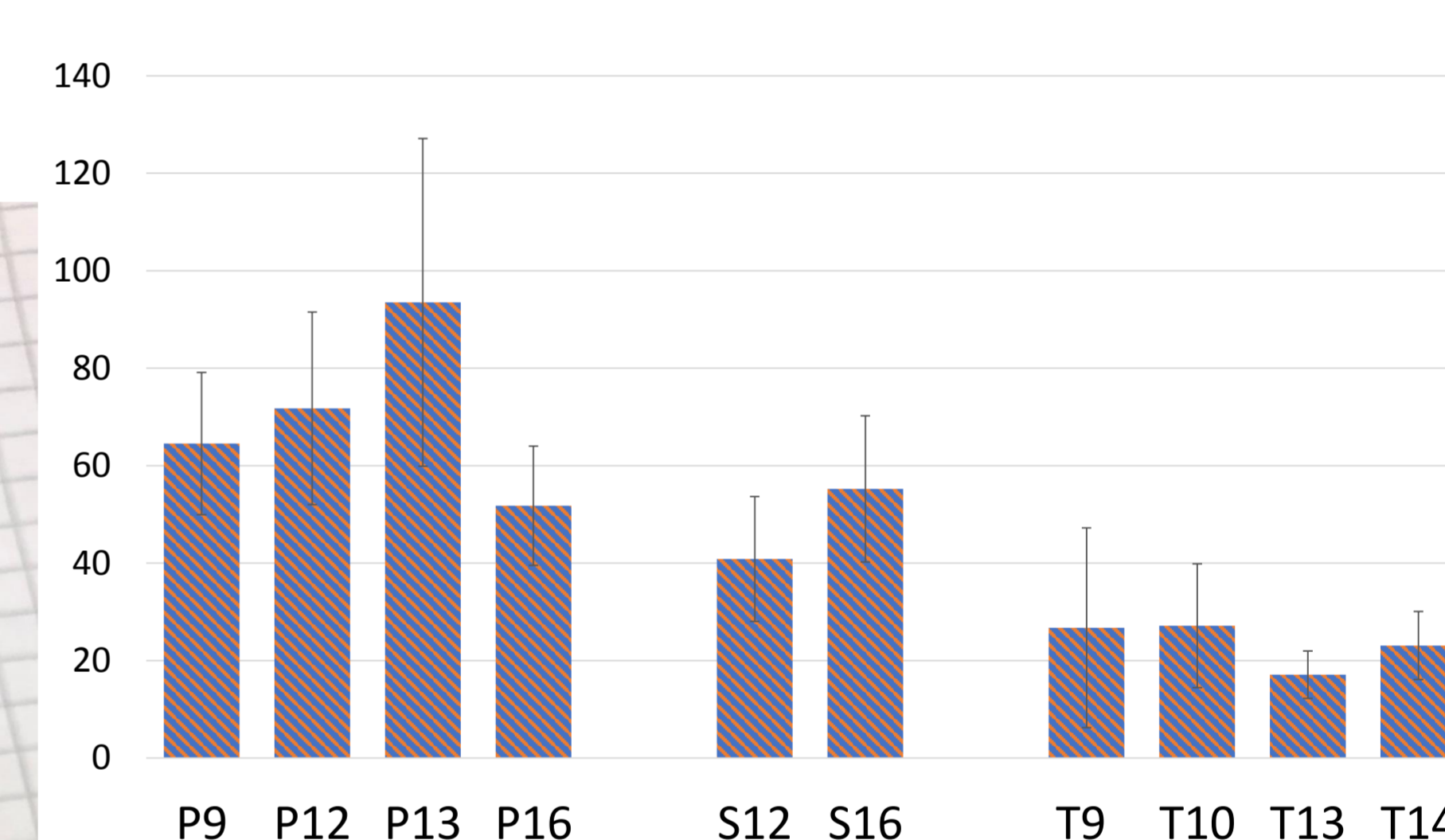
DISTRIBUTION BETWEEN MUCOUS AND SKIN

■ Skin ■ Mucus

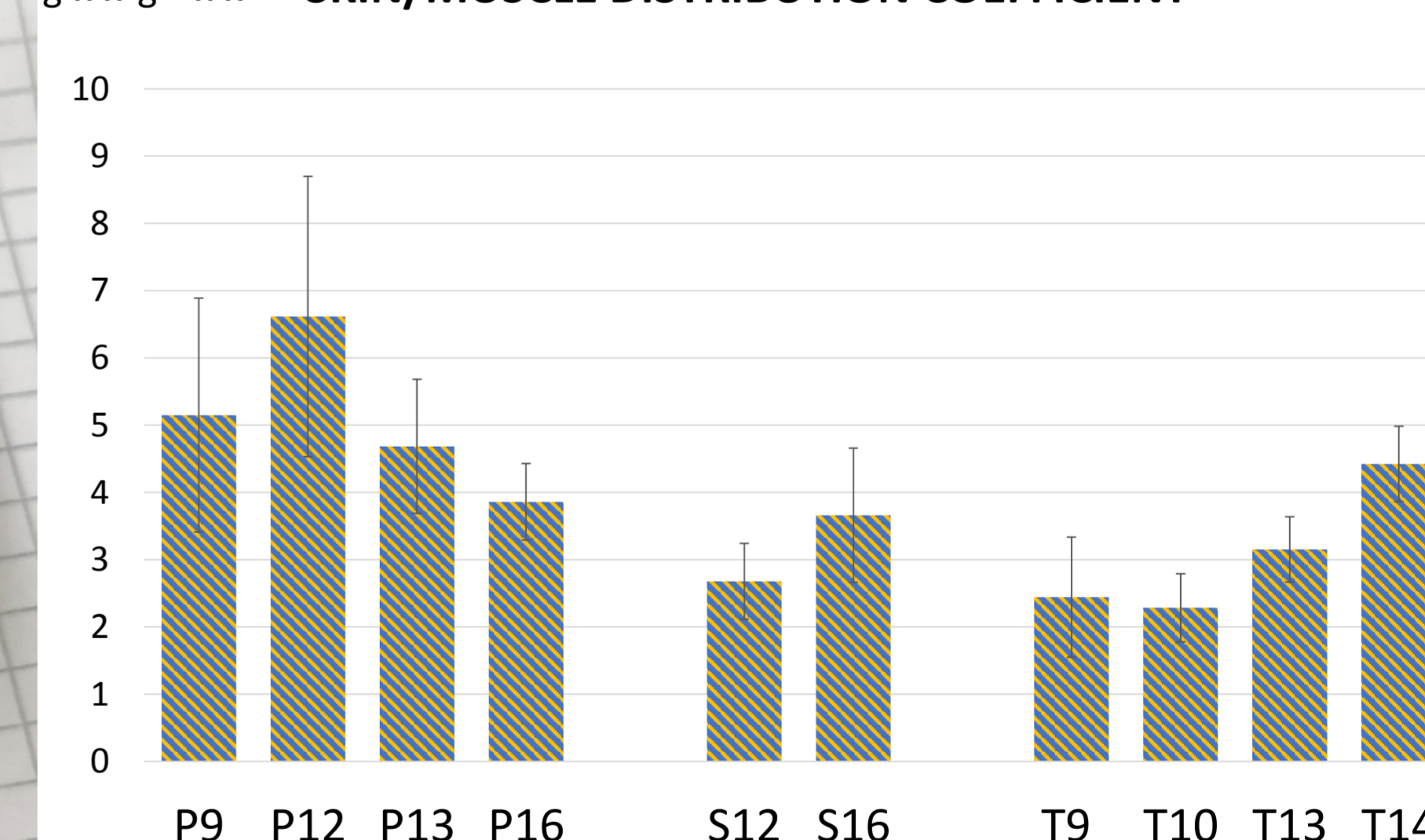


Tissue/muscle distribution coefficients similar across test chemicals for liver and skin, but not for gills

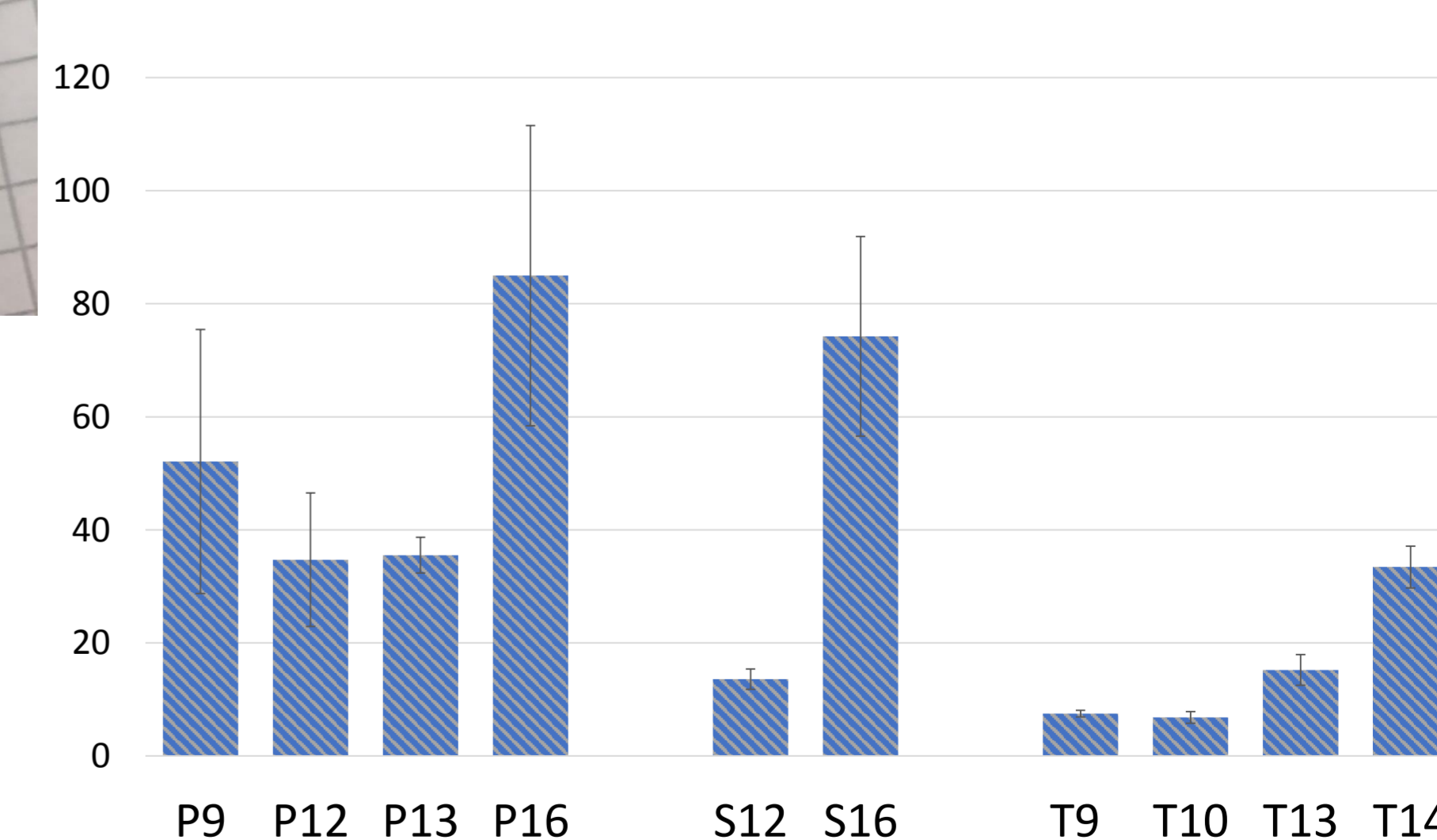
LIVER/MUSCLE DISTRIBUTION COEFFICIENT



SKIN/MUSCLE DISTRIBUTION COEFFICIENT



GILL/MUSCLE DISTRIBUTION COEFFICIENT



Conclusions

- The analytical method for fish is satisfactory.
- All surfactants enter the fish in significant quantities, and all adsorb to the surface in significant quantities.
- It is unclear if rinsing the skin with methanol removes all adsorbed chemical.
- The gills are a significant repository of these cationic surfactants in fish, whereby a significant portion may be adsorbed to the gill surface.

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Acknowledgment

This work was funded by the European Chemical Industry Council Long-Range Research Initiative through the project: *Developing a Bioaccumulation Assessment Strategy for Surfactants (D-BASS)*.
<http://cecic-iri.org/projects/eco37-d-bass-developing-a-bioaccumulation-assessment-strategy-for-surfactants/>