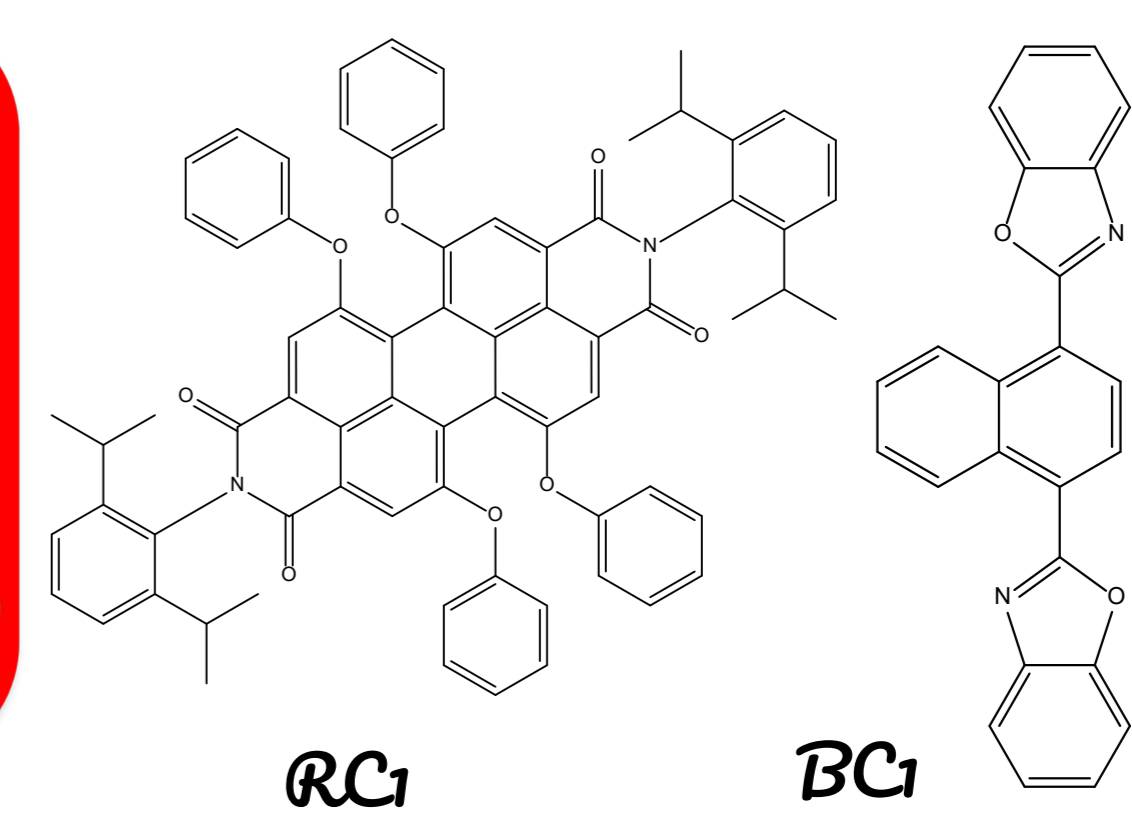
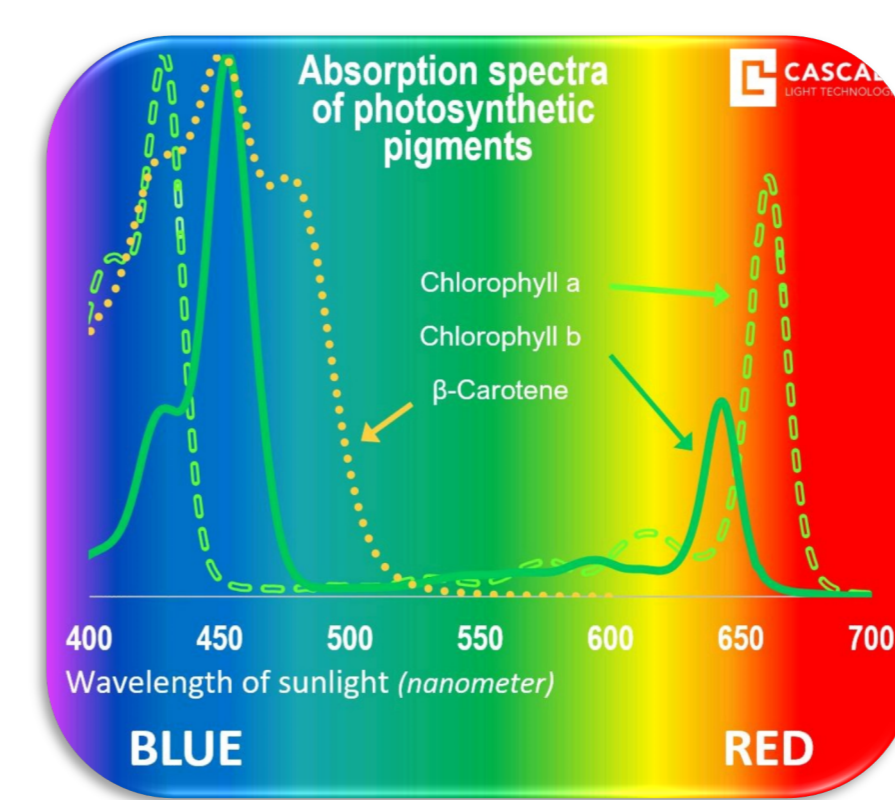


Risk Assessment of Plastic Greenhouse Films formulated by Non-Evaluated Polyaromatic Hydrocarbons

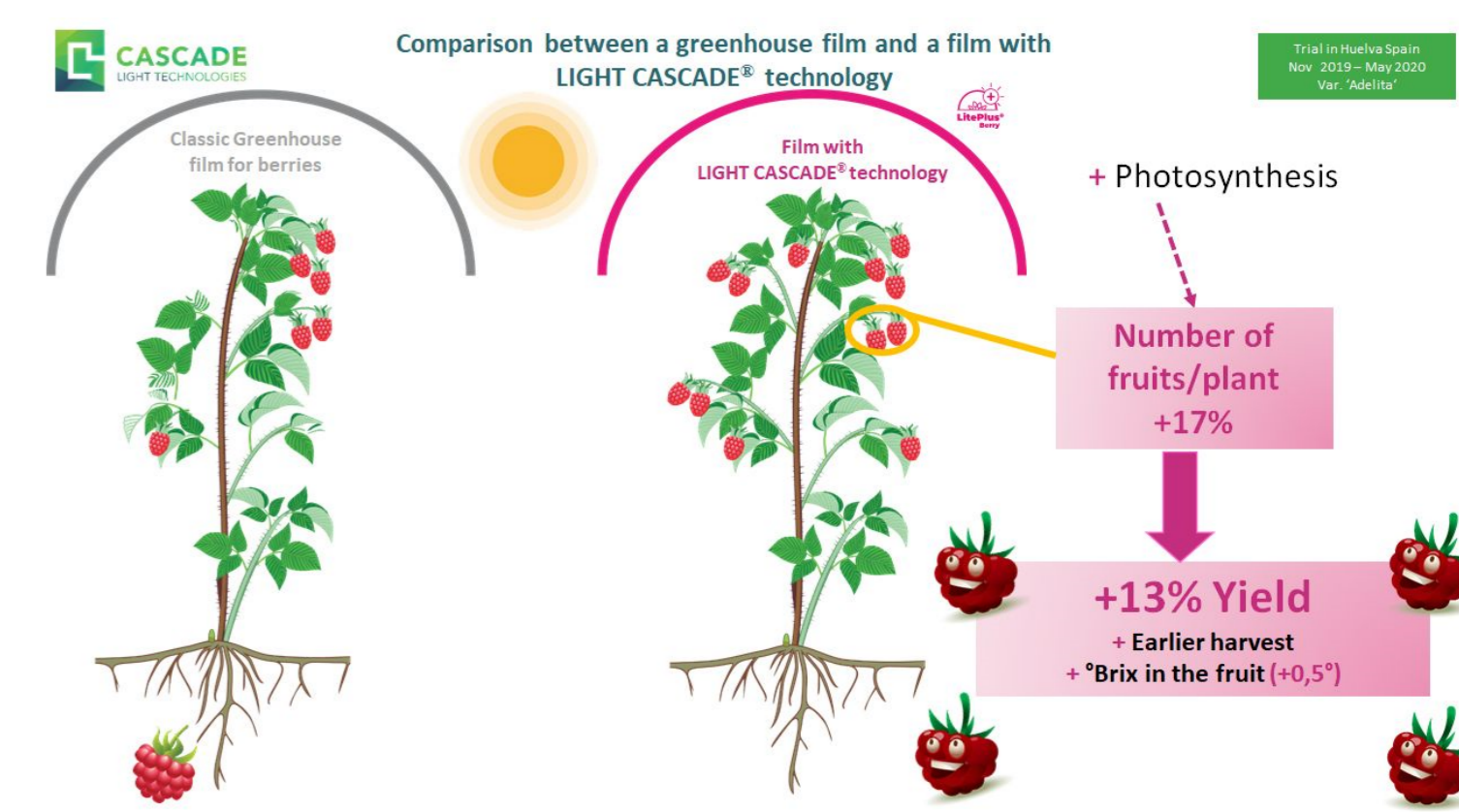
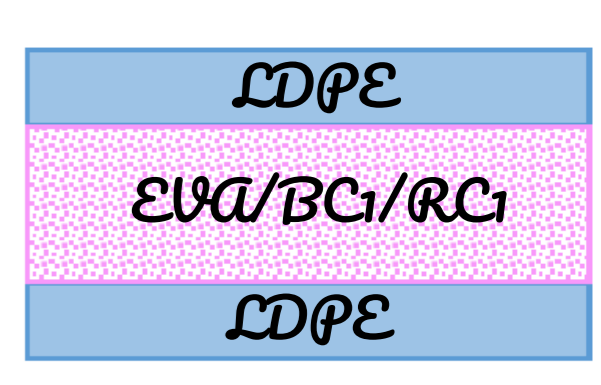
Summary

New green, costly effective technology is developed by Cascade to enhance the yield and quality of a variety of crops through the formulation of the plastic greenhouse films by two fluorescent polyaromatic hydrocarbons (PAHs), BC1 and RC1. They optimize the natural sunlight by wavelength selection and maximizing the diffusion distribution.

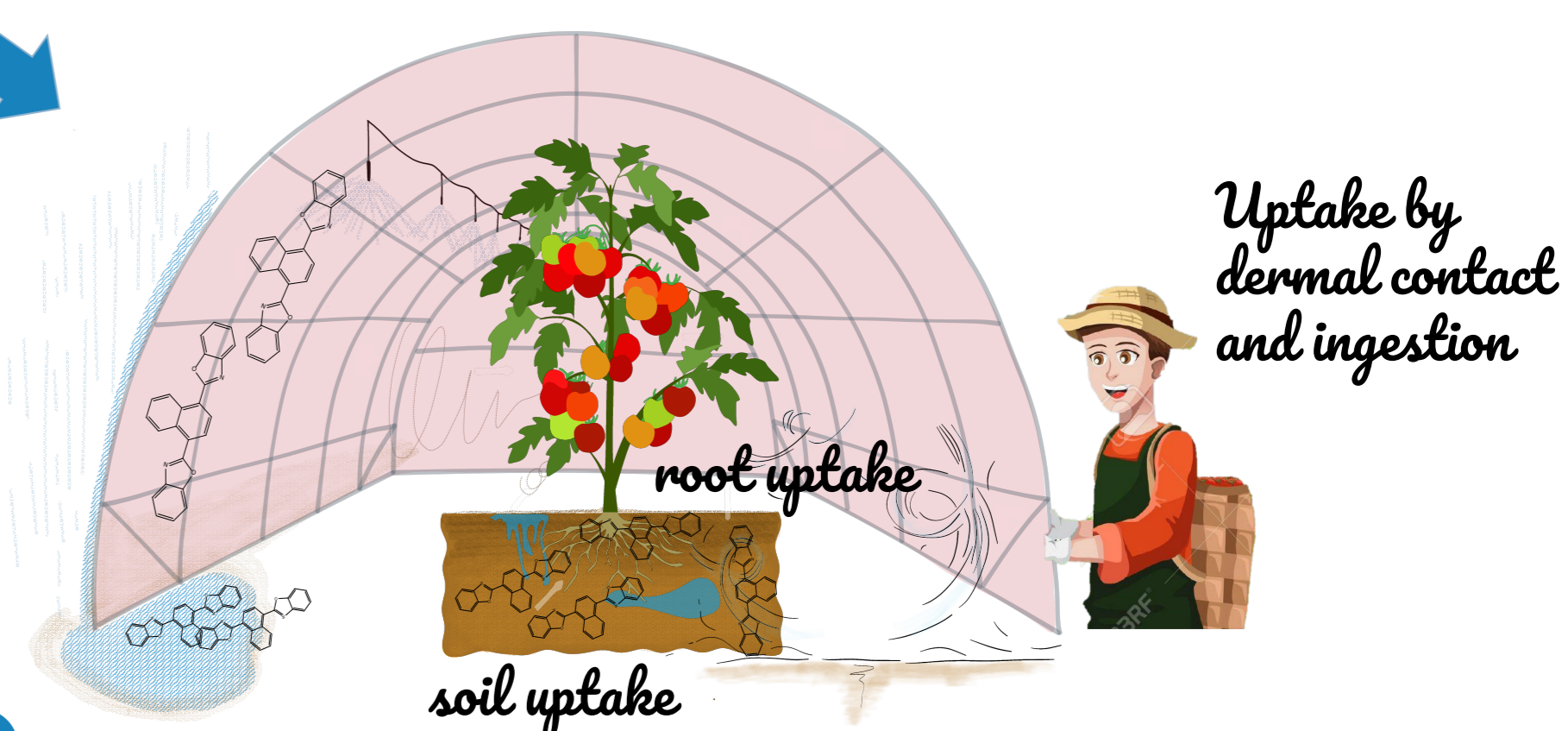
Referring to ECHA decision, the low solubility of PAHs doesn't claim their low bioactivity. The European Commission (EU) No 10/2011 regulate the risk of plastics that come into **direct contact** with food. A maximum level of 10 ppb in food is authorized for non-evaluated substances, which is the case for BC1 and RC1, where RC1 is not even registered under REACH. Greenhouse are **open system in indirect contact** with food. So, a risk assessment study is developed to evaluate the exposure of human health and environment to the BC1 and RC1. **Acceptable threshold, C_{thresh}^{TTC}** are developed based on **TTC** and the **Cramer class** classification of each substance. The risk of exposure is mainly controlled by two main parameters: Diffusion in the film D_P and partitioning between film and water $K_{water/P}$ based on water solubility.



37 μm to 200 μm
Film thickness

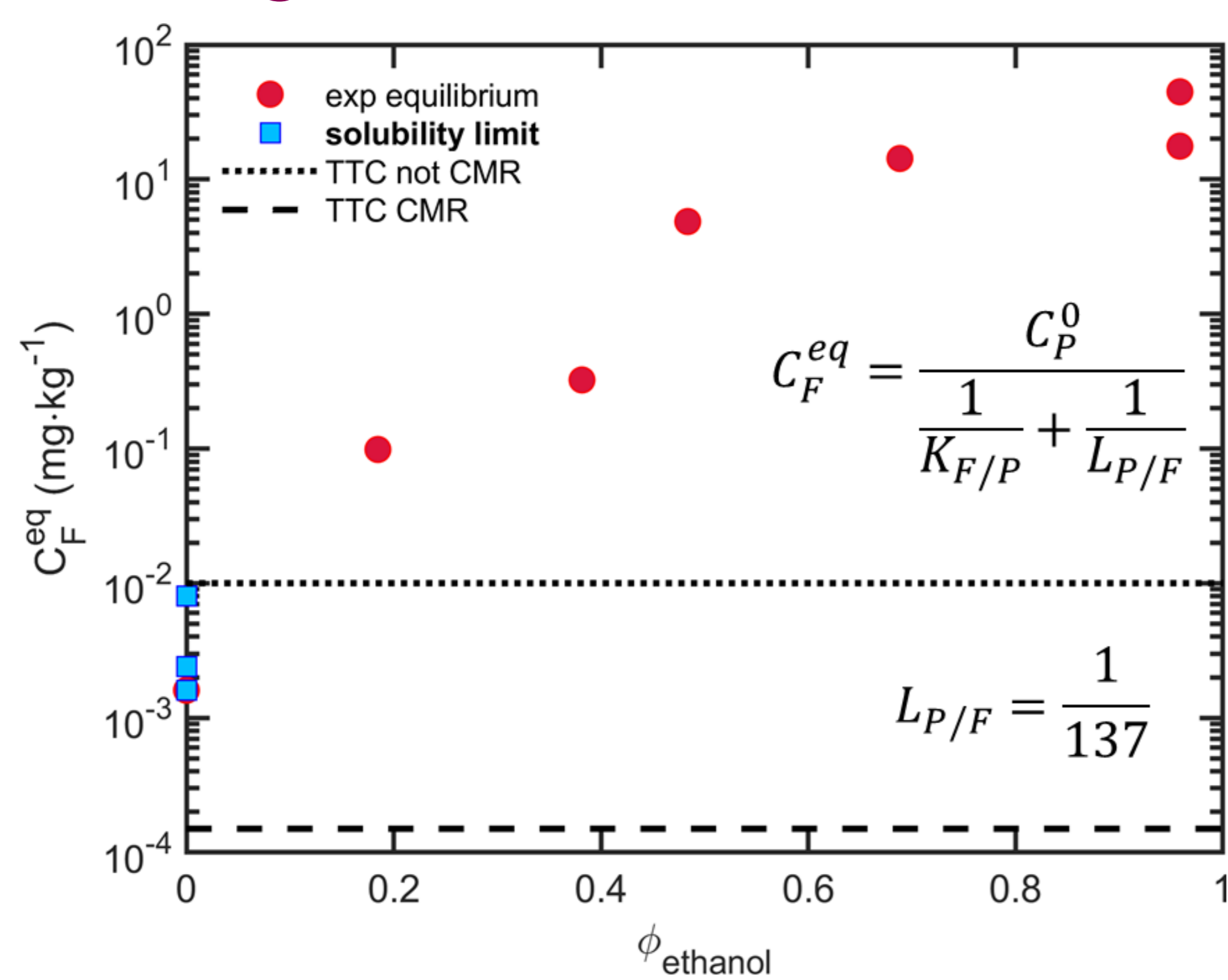


Risk of PAHs for human health and persistence in the environment



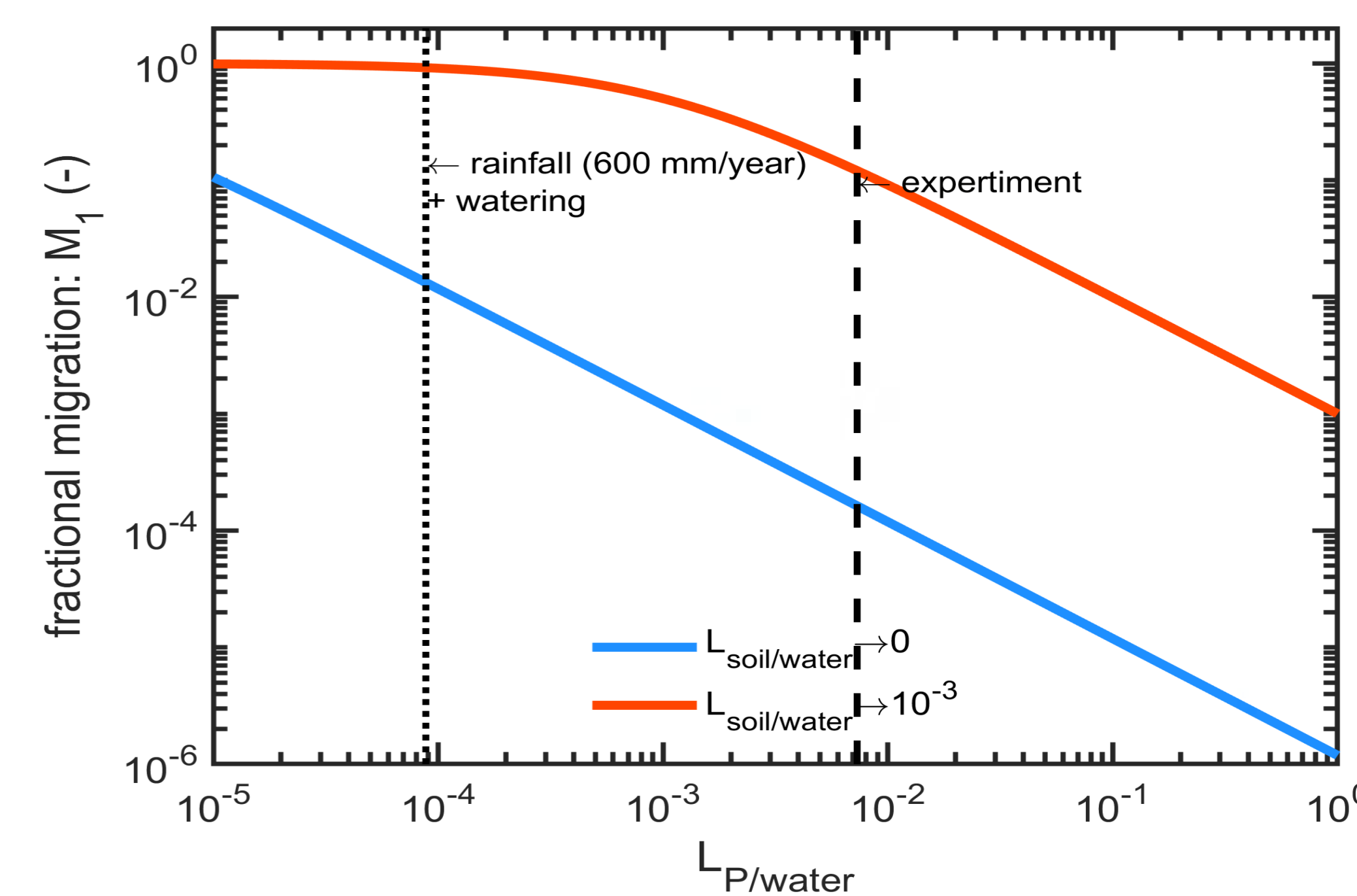
First Tier Risk Assessment: Non-Contact Migration

Migration of BC1 in Water/ETOH



- Migration of BC1 in system Film-Water (S-water) cannot explain its total loss from the film based on C_F^{eq}
- The presence of soil (R) with chemical affinity for BC1 mediates the migration → S-water-R → higher fractional migration
- The overall mass transfer resistance between S and R decreases by replacing water with hydroalcoholic solution

Model



Acceptable thresholds based on TTC

$$C_{thresh}^{TTC, genotoxic} = TTC \mu g \cdot kg_{BW}^{-1} \cdot day^{-1} \times \frac{\text{body weight}}{\text{daily intake}}$$

Exposure Risk by Ingestion

Exposure/Target	Adult (60 kg, daily intake 1 kg)	Infant (5 kg, daily intake 0.75 kg)
Exposure at tier 1 (overestimated)	40 μg · day ⁻¹	30 μg · day ⁻¹
Conclusion	Acceptable Risk	Several factors take role

$C_{thresh}^{TTC, genotoxic}$

Adult = 90 μg · day⁻¹

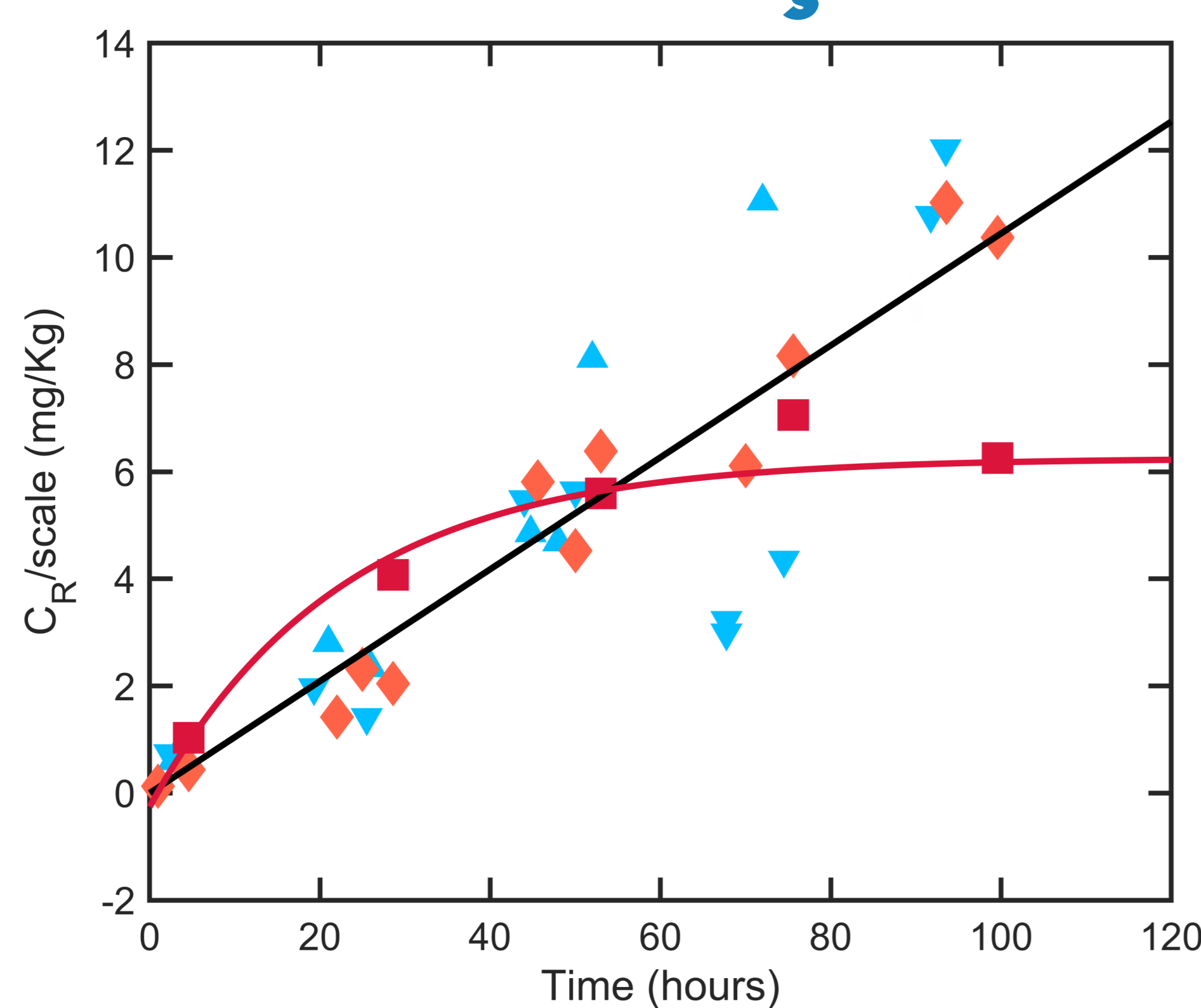
Infant = 7.5 μg · day⁻¹

Exposure Risk by Direct Contact

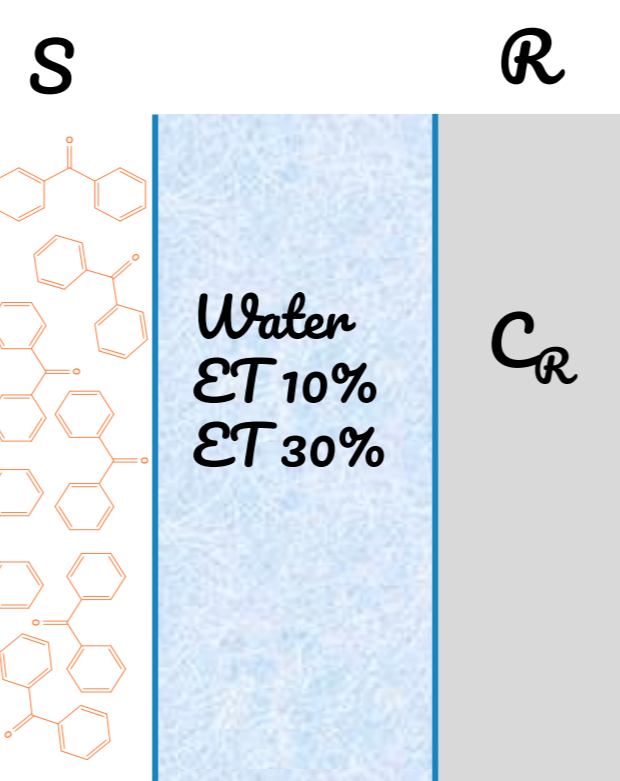
Acceptable Risk, Gloves recommended

$$M_{skin} = \frac{\rho_{skin} A_{skin} l_{corneum}}{l_p + \frac{K_{ethanol/P}}{3}} C_P^0 = 10 \mu g / \text{hand} / 1 \text{ hour}$$

Experiment



- ETOH 0% ($r_1, \text{scale}=1$)
- ETOH 0% ($r_2, \text{scale}=1$)
- ETOH 10% (scale=1.5)
- ETOH 30% (scale=40)
- linear model (ETOH ≤ 10%)
- exponential model (ETOH=30%)



Partners

Project ECLA 'Efficiency of Light Waterfalls for Agriculture', collaborative project financed by ADEME and directed by Cascade industry. Five partners:

Cascade, Agripolyane, INRAe (IRHS), INRAe (UMR SayFood, ModIC), Université Claude Bernard Lyon 1 (LAGEP).

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