Impairment of sensory organ development in petroleum-exposed zebrafish embryos - response of the visual system

The oculotoxic mode of action of environmentally relevant concentrations of crude oil was demonstrated on multiple levels of biological organization:
- Downregulation of genes associated to phototransduction
- Disruption of retinal lamina organization
- Reduced response in light-dark transition

Aims & Objectives
- Does the oculotoxicity of crude oil also manifest in visual function?
- Are also other behavioral patterns affected by crude oil exposure?

Take-home messages
- The visual system is a main target of crude oil toxicity.
- Environmentally relevant conc. affect locomotion behavior

Acute Toxicity

**Results**
- LEWAF: 25%
- CEWAF: 1.5%
- Similar sensitivity of wildtype and transgenic zebrafish embryos
- Increased acute toxicity by addition of chemical dispersant

Spontaneous tail coil
- Tail coil frequency of 24 hpf embryos

- Interference of crude oil components with motoneuron connectivity [2]
- Interaction of crude oil components with neurotransmitter system [4]

Conclusion
- Reduction of opn1lw2-PRC count indicates reduced visual capacities
- Strong behavioral alterations at very low concentrations that may also affect population level [2]

The results shown here strengthen the line of evidence for an oculotoxic mode of action of crude oil.

**Experimental Setup**

**Preparation of water-accommodated fractions (WAF)**
- LEWAF: 1:50
- CEWAF: 1:200
- HEWAF: 1:200

**Setup**
- 24 spontaneous tail coil
- 72 touch-evoked response
- 120 hpf opsin response

**Opsi Response**

**Method**
- Retinal cyrosections (12μm, coronal) of tg(lwLWS) transgenic zebrafish [11]
- Contocal LSM of opn1lw2-mKate
- ImageJ quantification
- Opn1lw2 photoreceptor (PRC) count
- Opn1lw2 signal intensity

**Opnlw2-PRC count**

- Negative control
- MKate

**Discussion**
- PRC count
- Underlying modes of action
  - Oxidative stress → apoptosis in retinal pigment epithelium and photoreceptor cells [11]
  - Interference with Ca²⁺ membrane permeability [79]
  - AHR-dependent pathway [12]

**Literature**


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