Comparative effects of three PAH fractions from light and heavy crude oils and from a PAH-contaminated sediment on Oryzias latipes Japanese medaka early life stages

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Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous in aquatic environment and accumulate in sediments. A novel approach was recently proposed to evaluate the toxicity of the bioavailable fraction of hydrophobic pollutants with the Japanese medaka embryo-larval assay and sediment-contact exposure ($MELA_{sed}$). Fish early life stages are suitable models for toxicity testing since they are sensitive to a wide range of chemicals and are considered as an *in vitro* assay by the EU animal experimentation legislation. The assay consists in a direct contact exposure of embryos with chemical-spiked artificial sediment during their whole development until hatching. Several endpoints are recorded at different developmental stages.

This work aimed to compare the developmental toxicity of three PAH complex mixtures extracted from a PAH-contaminated sediment (Seine estuary, France) and two crude oils (Arabian Light and Erika) at three different environmental concentrations roughly equivalent to 0.5, 4 and 10 µg total $PAH.g^{-1}$ d.w. sediment. These extracts are characterized by different PAH compositions and proportions. Pyrolytic extract from the Seine estuary (France), mainly composed of non-substituted molecules, delayed hatching, induced deformities, disrupted larvae swimming activity, and damaged DNA notably at the highest concentration tested. Besides, light and heavy petrogenic extracts composed of 65 and 40% respectively of methyl-naphthalene and methyl-phenanthrene molecules, induced acute effects. Hatching rate of exposed individuals was significantly reduced by 70% at the intermediary concentration tested and no individual hatch at the highest concentration for both petrogenic extracts. PAH fraction from Arabian Light oil induced more teratogenicity and larvae swimming activity failure than PAH fraction from Erika oil.

This study highlighted the high sensitivity of medaka embryos to PAHs and the differential toxicity of pyrogenic and petrogenic PAHs. It also demonstrated the $MELA_{sed}$ relevance to evaluate toxicity of particulate-bound pollutants. Authors would like to thank the French ANR CES for financial support and the CEDRE for providing crude oils.

Keywords: developmental abnormalities – DNA damages – larvae behaviour – crude oil extract – pyrolytic extract

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