

The in-vitro "Kinspec" test was developed for measuring toxicity in isolated membranes of a photosynthetic bacterium. However, high membrane density and low aqueous solubility of hydrophobic chemicals limits applicability of this assay. These limitations were overcome by introducing a kinetically controlled dosing system. Polydimethylsiloxane (PDMS) loaded with selected PAHs was used to expose solutions containing membranes. Key advantages of this system are avoiding co-solvent and the ability to generate stable exposures up to the solubility of test substances. Method development included determination of PDMS-water and chromatophore-water partition coefficients, desorption rates and diffusion resistances in both PDMS and membrane suspensions. Initial results demonstrate the utility of the "Kinspec" test. Observed perturbations in membrane potential were related to membrane PAH concentrations and were found to be of the same magnitude as lethal body burdens of narcotics reported in in-vivo toxicity tests. Therefore, this in-vitro test may serve as a promising screening assay for hazard assessment.

TU 114

Persistent Organic Pollutants in human blood in Singapore

Jing Tan, A Loganath, YS Chong, JP Obbard
SINGAPORE, Singapore

The ubiquity of persistent organic pollutants (POPs) in various environmental media and human tissues has become a matter of significant concern due to their potential adverse effects on human health. However, there is a paucity of data available from Singapore. 20ml of blood samples were obtained from each 49 volunteers who have lived in Singapore for at least 5 years. The residual levels of POPs, namely organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs) were determined by gas chromatograph coupled with a mass spectrometer. Organochlorine pesticides (OCPs) were detected in all samples with p,p'-DDE (median 141 ng g⁻¹ lipid) most abundant. Total PCBs (41 congeners) were in a range of 0-124 ng g⁻¹ lipid, and concentrations of the sum of 7 BDE congeners varied from 0 to 30.1 ng g⁻¹ lipid - generally lower than that of PCBs and OCPs. A model was established using partial least squares regression (PLSR). Levels of POPs were regressed against variables (i.e. age, BMI, dietary patterns, gender) to interpret the inter-relationships. Age was found to be positively correlated with some pesticides and PCBs, but negatively correlated with BDEs. Seafood, fish and chicken consumption increased the levels of PCBs, but no significant difference of POPs levels was found between males and females. Future application of non-linear data analytical techniques such as artificial neural networks (ANNs) and support vector machines (SVMs) may be required to enhance model efficacy.

TU 115

The in vivo toxicity of fluorotelomer acids to several common North American freshwater organisms

B Mitchell¹, Paul Sibly², A Myers², S Mabury², KR Solomon¹

¹University of Guelph, GUELPH, Canada

²University of Toronto, TORONTO, Canada

Perfluorinated surfactants (PFSs) are used globally in surface treatment applications, as their unique chemical properties allow them to repel both oil and water. Current evidence suggests that many PFSs form as part of a degradation pathway beginning with fluorotelomer alcohols. Fluorotelomer carboxylic acids (FTCAs) are a class of intermediate degradation products within this transformation pathway and are likely to be found in surface waters. Using aquatic invertebrate and plant species, we recently showed that FTCAs are two to three orders of magnitude more toxic than their perfluorocarboxylic acid counterparts. While these results indicate the potential for greater risk of FTCAs in aquatic systems, additional data on a broader spectrum of organisms is required before a definitive answer can be reached. Building on our previous studies, therefore, we recently initiated an investigation into the in vivo toxicity of the 6:2, 8:2 and 10:2 saturated and unsaturated FTCAs toward two species of algae, the amphipod *Hyalella azteca*, the midge *Chironomus tentans* and the fathead minnow. A key goal of this work is to identify whether the toxicity reflects a direct response to the FTCA's themselves or to their metabolites in tissue residues. Results for the tests with algae and *H. azteca*, along with preliminary tissue residue data, will be presented.

TU 116

What causes toxicity of PAHs in early life stages of fish?

Jani O. Honkanen

Akvaplan-niva, TROMSØ, Norway

Many polycyclic aromatic hydrocarbons (PAHs) are biotransformed via cytochrome P450 1A (CYP1A) in fish. CYP1A becomes functional well before hatching and active feeding during early development in many fish species. Toxicity of many PAHs and structurally related compounds has been connected to CYP1A induction and possible bioactivation. However, very little is known how other enzymatic reactions are involved in PAH metabolism and at what stage they become functional during early development of fish. For example, glucuronide conjugation has been shown to be the main conjugative route for many PAHs in adult fish but recent studies have shown that conjugation capacity is not fully developed in yolk-sac fry of salmon (*Salmo salar*). Instead of glucuronide conjugation, sulphate conjugation has been shown to be the main conjugation route of PAHs in salmon yolk-sac fry. Since sulphate conjugates are poorly excreted in early life stages of fish, it is suggested that formation and accumulation of potentially reactive sulphate conjugates is an alternative explanation for relatively high toxicity of many PAHs in early life stages of fish.

TU 117

Can fish adopt the same defence strategy in gill and liver to face chronic metal exposure?

Conceição Fernandes¹, António Fontainhas-Fernandes², Maria Antónia Salgado³, Joao Carrolo⁴

¹Instituto Politécnico de Bragança, BRAGANÇA, Portugal

²Universidade de Trás-os-Montes e Alto Douro, VILA REAL, Portugal

³Instituto de Ciências Biomédicas de Abel Salazar, PORTO, Portugal

⁴University of Trás-os-Montes and Alto Douro, VILA REAL, Portugal

Fish gill is one of the major target organs for waterborne trace metals. Liver is crucial in basic metabolism and is the main organ of toxic substances accumulation and their regulation. Among fish, mullet is one of the most resistant inhabiting polluted waters. *Liza saliens* is the dominant species in a coastal lagoon (Northwest coast - Portugal), which has been under investigation concerning histological and biochemical issues in response to environmental stressors, especially Cu and Zn. Previous studies showed that liver is the main organ involved in Cu metabolism and that its high Cu concentrations were age dependent. Zn metabolism involved 3 tissues: it was regulated in liver whereas it increased in gill with age and was partitioned with muscle. In this study, branchial and hepatic tissue ultrastructure showed that lesions prevalence and number of simultaneous lesions was larger in gill than in liver. Induction of antioxidant enzymes is a mechanism of adaptive response in fish and varies among tissues. *L. saliens* proved to be able to increase CAT and SOD activities in these organs suggesting a compensatory tissue response mechanism to face metal exposure.

TU 118

Assessment of critical body residues for Cadmium in aquatic biota

William Adams¹, David DeForest¹, Kevin Brix²

¹Rio Tinto, MAGNA, United States of America

²Parametrix, BELLEVUE, WA, United States of America

³EcoTox, JACKSONVILLE, FL, United States of America

We conducted an assessment of the critical body residue (CBR) concept for cadmium (Cd) in aquatic biota. Based on a scientific literature review, a database of chronic toxicity studies was developed in which Cd concentrations were measured in whole body or individual tissues. Only laboratory toxicity studies in which Cd was the only toxicant tested were included in the database. Overall, studies in which chronic Cd toxicity and whole body Cd residues could be linked were identified for more than 30 species of aquatic biota, and concentration-response relationships between whole body Cd and toxicity were consistently observed. The majority of the data compiled were for fish and arthropods and the following trend in sensitivities was observed: fish > arthropods > amphibians > molluscs > annelids. Given that Cd is a non-essential metal and is not well regulated via mechanisms of active uptake and excretion it appears that whole body Cd concentrations in aquatic biota are generally reflective of concentrations in abiotic media, which perhaps increases the feasibility of developing a Cd CBR(s). Using a species sensitivity distribution (SSD) approach, preliminary estimates of the 5th percentile no observed effect concentration (NOEC), lowest observed effect concentration (LOEC), and geometric mean of bounded NOECs and LOECs are 0.09, 0.7, and 0.4 µg/g dry wt., respectively. However, it is clear that more studies, at environmentally relevant concentrations, are needed to better understand (1) the influence of combined waterborne and dietary exposures on Cd bioaccumulation and toxicity and (2) the relationship between Cd bioaccumulation rate (uptake, detoxification, and excretion rates) and Cd toxicity. In addition, reviews of existing field studies published in the scientific literature would help to "ground truth" whether possible Cd CBRs are relevant to natural situations.