fractions for the biomarker determination. Results obtained show a relationship between the change in levels of the biomarkers measured in the crabs and the chemical characteristic of the sediment. Assuming that EROD in crab represents a PAH-oxidizing capacity, the results suggest a the capability for the detoxification of PAH in *C. maenas*.

Analysis of the effects of algal PSP toxins in the SAF-1 cell line from sea bream (*Sparus aurata*) using a cDNA microarray and DIGE

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Abstract

The primary mode of toxicity of heterocyclic guanidine toxins (saxatoxins, STXs) produced by marine gonyaulacoid and gymnodinioid dinoflagellate species is through binding to site 1 of the voltage dependent sodium channel in nerve cell membranes thus causing blockage of conduction and resulting in fatal paralysis. Little is known of other interactions or metabolism of these compounds and in this study we have used 'omic techniques to investigate other potential effects of STX's on non-neuronal cells. SAF-1 cells established from sea bream were exposed to a mixture of STX's (10 nM STX, NeoSTX, GTX's and others) for 48 h and then harvested for extraction of proteins and RNA. Protein expression profiling was performed using 2-D DIGE using a pH 4–7 gradient and 10% SDS PAGE. Analysis was performed with DeCyder (GE healthcare) software. Of 1300 matched protein spots, expression of 11 spots were decreased >2-fold with significance at $p < 0.1$ (by ANOVA) and only 3 were significant $p < 0.05$. None were elevated. Exposure to 25 nM STX alone resulted in down regulation of three spots of the less significant set and overexpression of 2 proteins ($p < 0.1$). Microarray analysis using the GENIPOL striped sea bream liver microarray showed upregulation of immune response genes and glutathione *S*-transferases by STX and the mixture. (*Supported by* EU GENIPOL Grant ENV-2001-0057 and NERC Grant NE/C507688/1).

Application of a biomarker protocol in the sea bass *Dicentrarchus labrax* to assess biological effects of diethylene glycol (DEG) and produced waters of Adriatic offshore platforms

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Abstract

Diethylene glycol (DEG) is used during oil and gas exploitation on offshore platforms, and a maximum concentration of 3500 ppm is allowed in produced waters by the Italian of Ministry of Environment. The aim of this work was to investigate whether environmental levels of DEG induce molecular or cellular responses in marine organisms, or synergistically modulate the effects of produced waters. Juveniles sea bass (*Dicentrarchus labrax*) were exposed to DEG alone (concentration range 50–5000 ppm) or to various mixtures of DEG and produced waters from three Adriatic platforms. Levels of cytochrome P450, bile metabolites and acetylcolinesterase activity were measured as exposure biomarkers. Oxidative stress measures included the main antioxidant defences (catalase, glutathione *S*-transferases, glutathione reductase, glutathione peroxidases, levels of total glutathione and accumulation of malondialdehyde), integrated with the measurement of total oxyradical scavenging capacity (TOSC) toward peroxyl and hydroxyl radicals. The loss of DNA integrity (single strand breaks and frequency of micronuclei) was analyzed as an index of cellular damage, and vitellogenin gene expression was selected as a marker of estrogenic effects. Results did not reveal marked effects in organisms exposed to DEG alone. On the other hand, significant differences were observed between the produced waters from the three platforms in modulating the biotransformation system, the oxidative stress indices and the onset of DNA damage. Co-exposure experiments revealed synergistic effects of DEG only during some experimental conditions, further confirming the chemical complexity and the different biological reactivity of produced waters from various off-shore platforms.

Assessing PAH detoxification in the clam *Ruditapes philippinarum*

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Abstract

The PAH detoxification system in the clam *Ruditapes philippinarum* was studied by analyzing the kinetics of phase I and phase II detoxification enzymes in digestive gland. Levels of phase I cytochrome P450A (CYP1A)-like enzymes were measured as ethoxyresorufin O-deethylase (EROD) activity and phase II by gluthatione-*S*-transferase. Analyses were performed on clams exposed to PAH-contaminated sediments after 7, 14, 21 and 28 days of exposure. Contaminated sediments were collected from two areas of the Spanish coast affected acutely (Galician Coast) and chronically (Bay of Algeciras) by oil spills; bioassays were performed under both laboratory and field conditions. Sediments from the selected sites were chemically characterized and the data obtained were compared with the biomarker results. A kinetic approach to the induction of these biomarkers potentially related to PAH detoxification in clam was performed.