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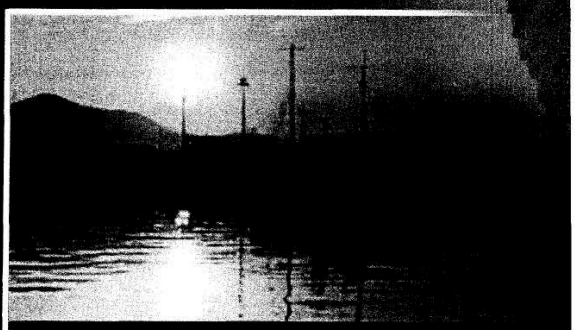
Proceedings of SECOTOX Conference and the International Conference on Environmental Management Engineering, Planning and Economics



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Japanese quail and rainbow trout exposure to methamidophos: lethal, sub-lethal effects and acetyl-cholinesterase biochemical and histochemical observations

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The beneficial, for agriculture, use of pesticides has raised social and scientific concern as regards their effects and potential risks for human health and the environment. In a tiered assessment framework, potential risk for organisms is identified on the basis of responses of individual organisms (bio-indicators) and biomarkers observed in controlled laboratory experiments.

We exposed two bio-indicators of significant social impact, one terrestrial the Japanese quail (*Coturnix coturnix japonica*) and one aquatic the rainbow trout (*Oncorhynchus mykiss*) in the organophosphate methamidophos using acute and dietary tests and acute and chronic tests, respectively. Mortality and sub-lethal effects were recorded in accordance to internationally accepted protocols. In addition, acetyl-cholinesterase, was estimated biochemically and histochemically in brain tissues of both species and in the duodenum of the quail. Organophosphates are established acetyl-cholinesterase inhibitors and therefore this biomarker is a fundamental parameter for bridging the gap between the effects on the individual bio-indicator and the effects on its physiology.

In the typical avian acute and dietary tests the LD/C_{50} values were estimated. Sub-lethal effects included lethargy, loss of coordination and lower limb weakness. Mortalities for the acute test occurred mainly in the first 1-2 hours following application, while for the dietary test occurred on days 4-5 (probably due to starvation). Substantial avoidance at all tested concentrations with a dose response relation was observed at the dietary test. Biochemical analysis in the brain indicates a strong acetyl cholinesterase dose-related inhibition. Histochemistry of the brain and duodenum offers significant data with respect to mortality and sub-lethal effects of the bio-indicators and in addition supports our biochemical observations of the effects of methamidophos.

As regards the rainbow trout acute and chronic exposure the EC_{50} values were estimated. In the acute test, mortalities were observed mainly in days 3-4. In the chronic test, mortalities occurred throughout the 3-week testing period. Sub-lethal effects ranged from sporadic spasms and loss of coordination to apathy in both types of tests. Acetyl-cholinesterase biochemistry and histochemistry of the rainbow trout brain results were similar to those observed for the quail.

We conclude that the use of biochemistry and histochemistry of the biomarker, acetyl-cholinesterase, may significantly improve the interpretation of the data obtained by the acute, dietary and chronic tests employed to assess the effects of methamidophos and other chemicals known to inhibit this very important nervous system enzyme.

Keywords: acetyl-cholinesterase; organophosphate; biomarker; bio-indicator; methamidophos.

Proceedings of the International Conference on Environmental Management, Engineering, Planning and Economics
Skiathos, June 24-28, 2007, Page: 244

Editors: A. Kungolos, K. Aravossis, A. Karagiannidis, P. Samaras