The lipid peroxidation in fish: from pond to plate

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ABSTRACT

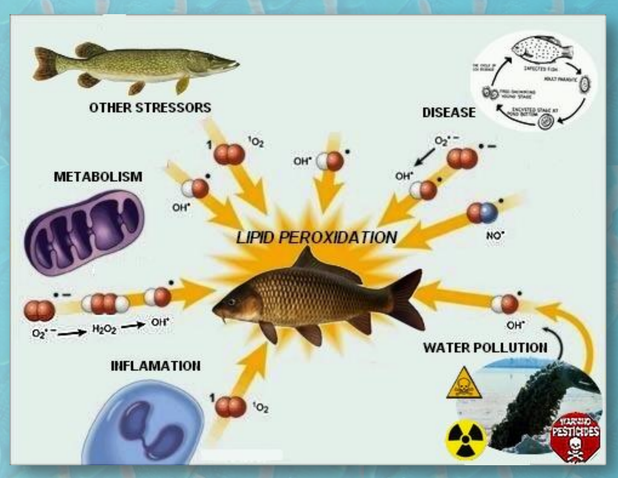
The integral parts of the aquatic environment are fish, which are endangered by many pollutants. The pollutants and their residues are widely found in surface and ground waters due to the intensity of agricultural and industrial production nowadays. One of the most frequently observed adverse effects of pollutants on fish is oxidative stress. Our results suggest that triazine herbicides, metribuzin and atrazine, induced oxidative stress followed by lipid peroxidation in embryo-larval stages of common carp and juvenile zebrafish.

INTRODUCTION

Fish are rich source of biologically valued food components. Fish meat is characterized by increased polyunsaturated fatty acids content, which very easily becomes a substrate for oxidation reactions. These oxidative changes are initiated by many physical, chemical, and biological factors (Fig 1).

All components of the cell, including polyunsaturated fatty acids, are sensitive to oxidation and are continually attacked by free radicals. This secondary lipid peroxidation process leads to malondialdehyde production and its level is a known as a biomarker of oxidative stress. The most widely used method for determining malondialdehyde is the thiobarbituric acid test.

Fig 1 Formation of free radicals



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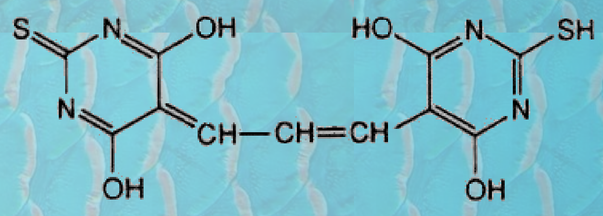
MATERIAL AND METHODS

In our first work (Hostovsky et al., 2012), the early-life stage toxicity test was performed on eggs of common carp (*Cyprinus carpio L.)*. In our second work (Blahová et al., 2013), the juvenile growth toxicity test was performed on early developmental stages of zebrafish (*Danio* rerio). After subchronic exposure to metribuzin and atrazine the lipid peroxidation was measured in whole fish body homogenates. To check lipid peroxidation, malondialdehyde was measured by the TBARS assay. Malondialdehyde (MDA) forms a 1:2 adduct with thiobarbituric acid (Fig 2) which can be measured by fluorometry or spectrophotometry.

Fig 2 Malondialdehyde-thiobarbituric acid complex



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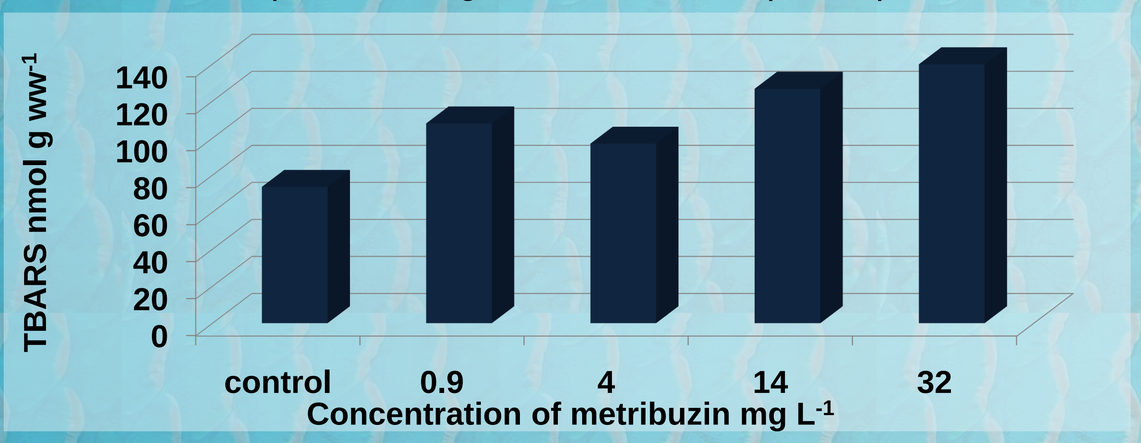
RESULTS

Our work showed effect of metribuzin (Graph 1) and atrazine (Graph 2) on lipid peroxidation. The comments and discussion is included in the concrete works (Hostovsky et al., 2012; Blahová et al., 2013).

Graph 1. Lipid peroxidation after metribuzin exposure in early developmental stages of common carp, compared to control.



Graph 2. Lipid peroxidation after atrazine exposure in juvenile zebrafish, compared to control.

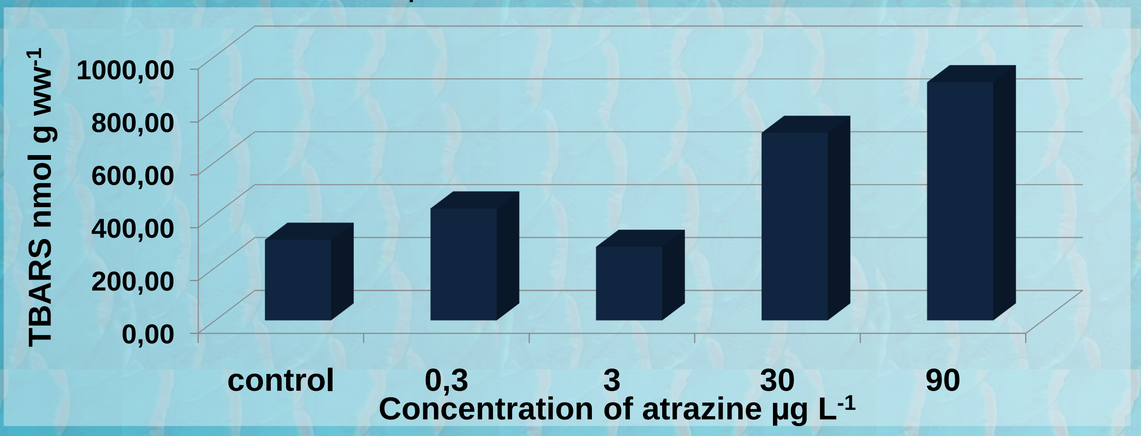
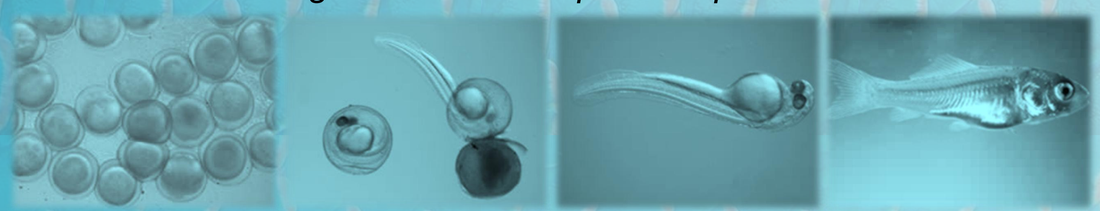


Fig 3 Common carp development



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CONCLUSIONS

This work demonstrated the profound influence of metribuzin and atrazine exposure on the oxidative stress marker of exposed fish. Many pollutants, including triazine herbicides, induced oxidative stress in early developmental stages of fish and the results of this work provide additional data with respect to environmental risk assessment. Investigation of oxyradical damage in the fish lipids, acute and chronic effects of free radicals induced in fish in vivo or post-mortem, and a potential bioaccumulation of lipid damage products must continue to the overall view on oxidative stress effects.

For references contact authors.

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