Opinion



# Effects of pollutants and role of the soil in the water toxicity

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## Opinion

The water quality of rivers, lakes and estuaries is monitored and assessed through government official bodies, with their appropriate rules, standards and criteria in relation to the amounts of pollutant compounds coming from different sources. Great part of water toxicity has been attributed to pesticides, herbicides, hormones, heavy metals, detergents and other organic compounds. Interestingly, sewage sludge, used in agriculture as a fertilizer, may contain several of these contaminants. Waterborne runoff and lixiviation are two of the mechanisms responsible to transport the chemicals from treated soils to water bodies, provoking adverse effects to the environment. In addition, industrial and urban effluents drainages are also responsible for the contamination of aquatic compartments. However, high levels of water contaminants may be hazardous to the ecosystem, and effects on aquatic invertebrates and fish can affect the entire community. We have been studying the toxic effects of several compounds in the microalgae Pseudokirchniella subcapitata, the microcrustacean Daphnia similis, and the fish species Metynnis argentus and Oreochromis niloticus. Pseudokirchneriella subcapitata is a unicellular chlorophyceae alga, widely used in studies of pollutants effects and recommended by regulatory agencies as a test organism. The microcrustacean Daphnia similis is frequently used in tests of toxicity since it is widely distributed in water corpus, has a relative short life cycle and is sensitive to various contaminants in the aquatic environment. Fish, important representative organisms in the aquatic food chain, are also regularly used in ecotoxicological studies. Metynnis argentus fish is an autochthonous species that belongs to the Characidae family; Oreochromis niloticus, originally from African rivers and lakes, is a highly consumed fish in many countries. Aquatic organism enzymes have been reported as good biomarkers of water pollution. For this purpose, different enzyme extracts from several organisms have been tested, from which the antioxidant enzymes, such as catalase, superoxide dismutase, glutathione reductase, are the best well documented. In this work, we have focused our attention to the *in vitro* effect of pollutants on the acid phosphatase activity of target organisms

1. *in vivo* effects of the mixtures of two compounds
2. Soil
3. In the toxicity of the Oreochromis niloticus fish.

### Sewage sludge/*in vitro* enzyme activity

From several pollutants present in the sewage sludge, only the heavy metal $Hg^{2+}$ and linear alkyl benzenesulphonate (LAS) detergent caused pronounced *in vitro* inhibitions on the algae Pseudokirchneriella subcapitata acid phosphatase.[1] However, no inhibition was detected by this metal in the enzyme obtained from the microcrustacean Daphnia similis.[2] On the other hand, an increase in the Pseudokirchneriella subcapitata acid phosphatase activity occurred in the presence of $Cu^{2+}$, due to one or more of the following factors: protection of the enzyme against thermal inactivation, increase in the enzyme-substrate affinity, and reduction of the activation energy, as detected from kinetic assays.[3] The high sensitivity of the enzyme crude extract to copper may be useful as a tool to detect this metal in natural waters and other environmental samples.[3]

### Diflubenzuron and p-chloroaniline/*in vivo* fish toxicity

The tilapia (Oreochromis niloticus) fish is widely found in fresh water and cultivated and consumed in many countries. The insecticide Diflubenzuron (DFB), used in some fish farming to control parasites, has no toxicity for the fish. However, this compound can be metabolized or degraded, generating p-chloroaniline (PCA), a highly toxic chemical compound. Accordingly, in the studies with DFB, the metabolite PCA must also be taken into account, since both compounds remain in the aquatic environment. Marking's[4] isobolograms can be used in order to evaluate the joint action of DFB and PCA. The effects on tilapia (Oreochromis niloticus) by exposure to mixtures of DFB and PCA were highly dependent on the concentration of the compounds. So, a synergistic effect was observed with 75% PCA in the mixture, but an antagonistic effect was detected with the mixture containing 25% PCA.[5]

### Effect of the soil/*in vivo* fish toxicity

In tilapia (Oreochromis niloticus) fish the presence of soil contributed to diminish the PCA toxicity, either individually or in combination with DFB.[5] In the aquatic environment, the compounds can be differentially associated to soil particles diminishing their availability to the organisms. The presence of pollutants in aquatic systems can be considered a significant environmental problem. Several methods have been developed in order to improve the water quality. Among these processes it can be included ion-exchange, membrane filtration, photocatalysis, bioremediation, adsorption, nano materials.[6–9] In our opinion, in the water toxicity by more than one pollutant, it is indispensable to study their combined action since addition, suppression or synergism could be occurring. In order to mimic the natural environmental condition, the presence of soil in such studies can give more confident results. To decrease the water pollution, bioremediation, using natural bacteria, fungi or plants has become a more worldwide accepted process.

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## Conflict of interest

Authors declare there is no conflict of interest in publishing the article.

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