PETRODIESEL VS BIODIESEL: A COMPARATIVE STUDY ON THEIR TOXIC EFFECTS IN NILE TILAPIA AND ARMOURED CATFISHES

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Figure 1. The potential toxic effects of biodiesel to the aquatic biota have been studied in fish in a project developed by the group of Prof. Dr. Eduardo Alves de Almeida at the São Paulo State University, Campus of São José do Rio Preto

It has been shown that diesel oil is highly toxic to aquatic animals. Much of the biochemical responses activated during diesel oil exposure in fishes involves induction of cytochrome P450, especially 1A isoforms, and glutathione S-transferases. Oxidative stress can be also originated as a result of increased cytochrome P450 reactions and redox-cycling reactions that generate reactive oxygen species (ROS) as by-products. These ROS can oxidize macromolecules such as lipids and DNA, leading to cell death. On the other hand, cells possess antioxidant defenses like the enzymes superoxide-dismutase (SOD), catalase (CAT) and glutathione-peroxidase, which are generally activated during oxidative stress situations. These responses can be accessed in exposed organisms to predict diesel effects. There is increasing interest on the production of biodiesel from plant oils and animal fats, as an alternative for no renewable petroleum-derived diesel oil. Besides biodiesel could be a renewable alternative as fuel, it has been proposed that it is also less deleterious to the environment. However, the toxic effects of biodiesel on aquatic biota is not fully studied. In this project, we aim to investigate how biodiesel can be less deleterious than petroleum diesel to tilapias (*Oreochromis niloticus*), and armoured catfishes (*Pterygoplichthys anisitsi*), through acute toxicity tests (96h) to establish LC100 and LC50 for both species, and the analyses of biochemical biomarker in fishes exposed for 15 and 30 days to sub-LC50 levels of these contaminants. The activities of cytochrome P450 isoforms, GST, CAT, and lipid peroxidation levels will be measured as toxicological parameters to indicate diesel and biodiesel effects.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

LC50 values for B5 and B20 biodiesel were obtained for tilapias (below 0.5 mL/L). Contrarily, the catfish did not die even at concentrations as high as 6 mL/L, indicating this species as very resistant for diesel or biodiesel exposure. On the other hand, both species presented significant alterations in several biochemical parameters. In general, P450 and GST activities were higher as the amount of petrodiesel increased in the mixtures, and no significant alteration was observed for fish exposed to biodiesel. Nevertheless, oxidative stress parameters were altered in all groups of fish exposed to pure diesel oil, mixtures of petrodiesel with biodiesel B5, B20 and even pure biodiesel (B100). These results indicates that, despite its less toxicity compared to petrodiesel, even pure biodiesel can represent a risk to aquatic biota, causing significant alterations in biochemical parameters. The project is just on its first year. We expect more results for the next year.

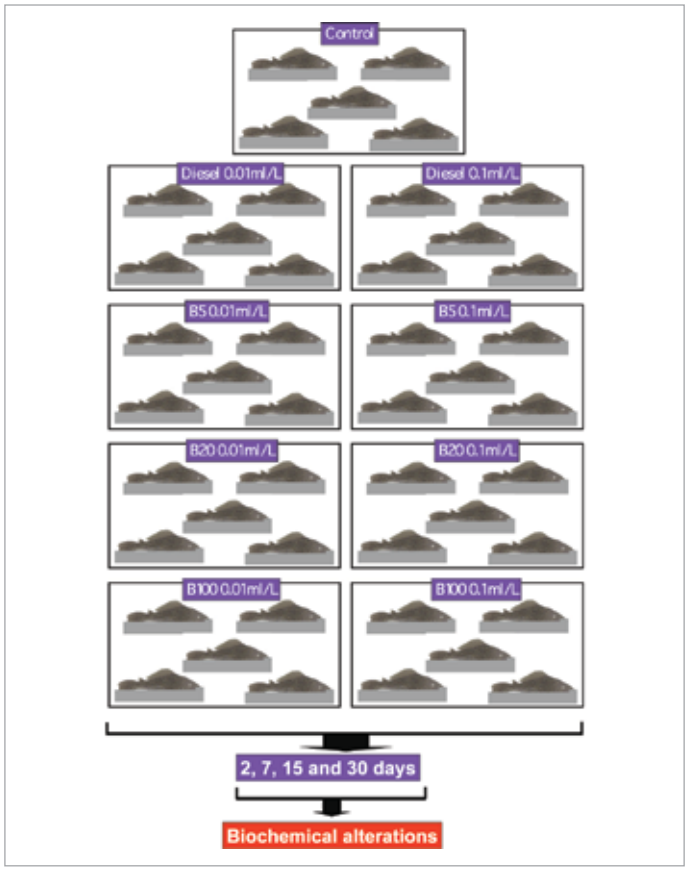

Figure 2. Fish are exposed to pure diesel, biodiesel and biodiesel blends at different concentrations for different periods of time, and then several biochemical parameters are evaluated and the results are compared to an unexposed control group, in order to identify the effects of these compounds to fish, and to evaluate how the addition of biodiesel in petrodiesel can decrease its toxicity to the aquatic organisms

MAIN PUBLICATIONS

Nogueira L, Rodrigues ACF, Trídico CP, Fossa CE, Almeida EA. 2011. Oxidative stress in Nile tilapia (Oreochromis niloticus) and armoured catfish (Pterygoplichthys anisitsi) exposed to diesel oil. *Environmental Monitoring and Assessment* (in press).

Nogueira L, Sanches ALM, Silva DGH, Ferrizzi VC, Moreira AB, Almeida EA. 2011. Biochemical biomarkers in Nile tilapia (Oreochromis niloticus) after short-term exposure to diesel oil, pure biodiesel and biodiesel blends. *Chemosphere* (in press).

Nogueira L, Almeida EA. 2011. Potenciais riscos ambientais do biodiesel. (Book chapter, being edited by the UNESP BIOEN group) (under edition).

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