quantified in the supernatant of body homogenates: (a) CYP450, assessed by a fluorometric protocol using 7-ethoxycumarine (7-EC) as substrate (ECOD); (b) glutathione S-transferases, with 1-chloro-2,4-dinitrobenzene (CDNB) and GSH as substrates; and (c) catalases (CAT), determined by recording the decomposition of H_2O_2. GSH content was measured using the Ellman reagent (5,5′-dithiobis(2 nitrobenzoic acid-DTNB). Protein concentration was quantified using Lowry assays.

Results: In untreated adults, ECOD activity was significantly lower in LSS than in FP ($P < 0.05$). In adult exposed to acetamiprid, ECOD activity was significantly higher in the FP at 50 and 100 ppm respectively. None of the concentrations applied modified the ECOD activity in the LSS respect to untreated ones. GST activity in FP adults exposed to 25 ppm of acetamiprid was significantly higher than untreated adults ($P < 0.05$). LSS individuals were not affected by any of the concentrations of acetamiprid tested. CAT activity from adults of both LSS and FP were unaffected by the concentrations of acetamiprid evaluated. The GSH content from FP adults was significantly higher at 25 ppm and 100 ppm respect to the control group ($P < 0.05$). LSS adults showed a significant increase of GSH content at 100 ppm compared to the control group ($P < 0.05$).

Conclusion: CYP450 activity increased in a concentration-dependent manner (6.25–100 ppm) in FP. A similar profile was observed for the GSH content in both FP and LSS. These results suggest that the increase of GSH content is a response to the oxidative stress generated by CYP450 or acetamiprid.

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PP5.4
Evaluation of phytoremediated sugarcane vinasse toxicity by micronucleus test in tilapia (*Oreochromis niloticus*)

T.A. Guedes [1], J.E. Correa [1], A.C.C. Marcato [1], M.C.F. Santos [2], C. Moreira-de-Sousa [1], C.S. Fontanetti [1]

[1] *UNESP, São Paulo State University, Rio Claro, São Paulo, Brazil*
[2] *UNIARARAS, Hermínio Ometto Foundation, Araras, São Paulo, Brazil*

Introduction: Brazil is considered one of the largest producers of sugarcane in the world; it has approximately 350 operant plants, with capacity to produce 16 billion liters of ethanol/year. This shows that this great production certainly generates a lot of waste and puts the country in worrying situation on the disposal of waste that production entails. The vinasse main waste generated by sugar industry is generated in a proportion fifteen times greater than ethanol; due to its high organic load and toxicity it was necessary to create alternative use of the same, as previously considerable amounts were released into water resources causing serious pollution problems. However, the indiscriminate spraying of this waste as fertilizer in the sugarcane crop still worries researchers for the possible effects that it can provide in organisms. In this sense it is necessary pretreatment of vinasse to reduce their toxicity. The use of biomarkers linked to micronucleus test has been an important tool in studies of toxicity of different residues and contaminants.

Objective: The objective of this study was to evaluate the toxicity of phytorremediated vinasse by water hyacinth (*Eichhornia crassipes*) through the micronucleus test and nuclear abnormalities in tilapia.

Materials and methods: Fifteen specimens of *O. niloticus* were used which they were exposed to the control group and phytorremediated vinasse for 7 and 15 days diluted to 5% for 96 h. The collected blood was subjected to the standard procedure for micronucleus test. Data normality was tested by the Shapiro–Wilk test and the significance between the groups was obtained by the nonparametric Kruskal–Wallis and Dunn's post hoc with significance $p < 0.05$.

Results: After analysis and quantification of the micronucleus and nuclear abnormalities slides it was observed low values of micronuclei and nuclear abnormalities for the phytorremetiated vinasse for 7 days similar to the control values. After 15 days of phytoremediation was observed a statistically significant further decrease of nuclear abnormalities, this value was lower than those observed in control.

Conclusion: Taking into account the high toxicity that the vinasse in natura presents the results obtained in this study indicate that the phytoremediation of vinasse by water hyacinth was effective in reducing its toxicity, being more effective after 15 days of treatment.

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PP5.5
Reduction of BOD values of sugarcane vinasse through bioremediation by water hyacinth (*Eichhornia crassipes*)

A.C.C. Marcato, C.P. Souza, C.S. Fontanetti

UNESP, Department of Biology, São Paulo State University, Av. 24A, 1515, Bela Vista, Rio Claro, São Paulo, Brazil

Introduction: The vinasse is a major waste of transformation of sugarcane into ethanol. It is usually acidic and with high content of dissolved organic carbon. The polluting power of this residual liquid derives from its richness in organic matter, low pH, high power of corrosion and high levels of biochemical oxygen demand (BOD), and high temperature in output of distillers. Thus, the vinasse is considered highly harmful to fauna, flora, microfauna and microflora of water resources. Due to the large amount of vinasse produced by the ethanol industry several alternatives for its reuse and reduced toxicity have been tested. The activity of some micro-organisms and plant species are useful in the recovery of polluted environments and are the basis of the concept of bioremediation. Considering the two processes, bioremediation may be defined as the process by which living organisms degrade or transform and detoxify hazardous organic and inorganic contaminants or residues in natural conditions into innocuous compounds, such as carbon dioxide and water, or less toxic forms. These transformations of environmental pollutants occur by the reactions that are part of their metabolic processes.

Objective: Thereby, the present study aimed at evaluating the effectiveness of using bioremediation with water hyacinth (*Eichhornia crassipes*) in the treatment of sugarcane vinasse.

Materials and methods: The vinasse was submitted to a period of decantation, after this period was filtered and submitted to phytoremediation with water hyacinth.

Results: Through physicochemical analysis was possible to monitor the progress of changes related to bioremediation. The most evident change was the reduction in the value of BOD. All samples had higher than 90% reduction. The possible factor responsible for the decrease in BOD is the oxidation of organic matter which provides energy for microbial metabolic processes and can be synthesized and incorporated into the cell mass. The organic matter present in the wastewater provides a substrate for the aero-

bic microbial metabolism as well as growth of aquatic plants, which favors the assimilation of nutrients and, consequently, improves the quality of the treated effluent.

Conclusions: Therefore, bioremediation with water hyacinth used in sugarcane vinasse showed to be effective in reducing the BOD and is an alternative for the treatment of this waste.

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PP5.6
Evaluation of the toxicity and genotoxicity of percolated from sugarcane vinasse in *Oreochromis niloticus* (PISCES) by micronucleus test

M.C.F. Santos[1,2], Y. Ansoar-Rodrigues[1], C. Moreira-De-Sousa[1], R.B. Souza[1], A.C.C. Marcato[1], J.E. Correia[1], L.I. Vasques[1], M.P.M. Coelho[1], C.P. Sousa[1], V.C. Rodrigues[2], C.A. Christofoletti[2], C.H. Kiang[3], B.J. Basso[3], A.A. Soto[3], C.S. Fontanetti[1]

[1] *Department of Biology, UNESP, Rio Claro, São Paulo, Brazil*
[2] *FHO|UNIARARAS, Araras, São Paulo, Brazil*
[3] *Department of Geology, UNESP, Rio Claro, São Paulo, Brazil*

Introduction: Brazil is a leading producer of alcohol and consequently, the largest producer of vinasse, residue derived from the distillation of ethanol. The use of this waste as fertilizer is an alternative to the reuse of the same, as well as being rich in organic matter, is an important source of replacement water and minerals to the soil. However, the substances present in this residue can undergo leaching and/or percolation and reach ground and/or surface water.

In this context, before use of large-scale vinasse in the sugarcane crops, it is necessary to evaluate the effects of percolated vinasse on aquatic organisms. Therefore, the micronucleus test is an effective tool in pollution monitoring of aquatic environments; when applied on fish, for example, demonstrates the ability of pollutants cause damage to genetic material. *Oreochromis niloticus* was chosen because it is one of the species most commonly used to evaluate the environmental contamination.

Objective: In the present work, micronucleus and nuclear abnormalities tests in erythrocytes of *Oreochromis niloticus* (Perciformes, Cichlidae) were performed to diagnose the toxicity and genotoxicity of percolated from sugarcane vinasse.

Materials and methods: A total of 40 specimens of *Oreochromis niloticus* (Perciformes, Cichlidae) were used. The bioassay was performed in replica, with exposure of the specimens to a pure groundwater (NC), crude vinasse (CV) and percolated vinasse (PV). The blood collected by cardiac puncture with heparinized syringes was subjected to the standard procedure for micronucleus test. Statistical analysis was performed by Kruskal–Wallis and Anova tests ($p < 0.05$).

Results: The main changes were micronucleated erythrocytes (MN), binucleated cells and in cell death. Among the nuclear abnormalities, the most noted were the nuclei type: "notched", "blebbed" and "lobed". The sample PV, although shown micronucleated erythrocytes, statistical values demonstrated a significant reduction in this endpoint when compared to CV; however, such values were also statistically significant compared to the NC. Samples of CV showed statistically significant values in relation NC for nuclear abnormalities and PV samples also showed significant values only in relation to CV.

Conclusions: It can be concluded that the soil can minimize the genotoxic effects of crude vinasse, acting as a filter, due to the significant differences between the erythrocytes of fish exposed to samples of VB and VP.

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PP5.7
Integrated biomarker response: An approach to assess antioxidant response in nesting green turtles

G. Rivas-Hernández[1,2], Y. May-Uc[2], S. Carrillo-Grajales[2], V. Cobos-Gasca[2], G. Rodríguez-Fuentes[3]

[1] *Facultad de Ciencias Naturales, Universidad Autónoma del Carmen, Carmen, Campeche, Mexico*
[2] *Facultad de Medicina Veterinaria, Universidad Autónoma de Yucatán, Mérida, Yucatán, Mexico*
[3] *Unidad de Química Sisal, Facultad de Química, Universidad Nacional Autónoma de México, Sisal, Yucatán, Mexico*

Introduction: Several defense mechanisms against oxidative stress and damage have been used as biomarkers. Single biomarker response is often difficult to interpret; therefore the use of integrated biomarker data into indexes for the evaluation of contaminant-induced stress has increased.

Objective: The aim of this study was to apply the integrated biomarker response (IBR) to a set of antioxidant biomarkers in order to assess their response in female green turtles, *Chelonia mydas*, nesting in the southern coast of Campeche, Mexico.

Materials and methods: From July to September 2014, blood samples (6–10 mL) were collected from 29 female *C. mydas* nesting in three sites along southern coast of Campeche: Isla Aguada (18°47′ N, 91°29′ W), Isla de Carmen (18°41′ N, 91°42′ W) and Sabancuy (18°59′ N, 91°11′ W). The antioxidant parameters measured included SOD, GPx, GST, GSH, lipid peroxidation and cholinesterase activity. Total variation of the biomarkers was calculated applying the IBR.

Results: Only GPx and SOD activity varied significantly among nesting sites. Nor did biomarker activity of the turtles correlate significantly with their length or curved carapace width. The IBR values and the star plots indicated significant differences in antioxidant biomarkers responses among nesting sites. The IBR values showed the arrangement of the nesting sites: Isla de Carmen (13.39) > Sabancuy (2.121) > Isla Aguada (1.278). The largest star plot area was obtained for Isla de Carmen as well as the highest scores by biomarkers (GPx, GST, SOD and lipid peroxidation).

Conclusions: The IBR allowed visual comparison of nesting sites indicating spatial variability of the biomarkers response. The IBR values and the star plots areas suggest that some factors triggered a higher oxidative stress and damage in the nesting *C. mydas* from Isla de Carmen.

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