

## STUDY OF OXIDATIVE STRESS IN ACUTE INTOXICATION WITH BENZENE ON *Mytilus galloprovincialis*

S. SCHIOPU\*, D. COPREAN, L. TOFAN

Faculty of Natural Sciences, Ovidius University Constantza, 124 Mamaia, Constantza, Romania

E-mail: [stelian@univ-ovidius.ro](mailto:stelian@univ-ovidius.ro)

**Abstract.** The goal of this paper was to study the oxidative stress phenomenon in context of benzene intoxication on *Mytilus galloprovincialis*. The biological material was 5-cm diameter mussels. Experimental lots: Martor (M); B I – the animals were intoxicated with 0.057 ml benzene/40 l sea water; B II – the animals were intoxicated with 0.114 ml benzene/40 l sea water; B III – the animals were intoxicated with 0.224 ml benzene/40 l sea water. The investigated tissues were gills and mantle. In the gills, benzene intoxication has produced marked modifications of the reduced glutathion content and the activity of glutathione-S-transferase in B II and B III lots. There was no effects in B I lot. In B II lot the glutathione content decreased. This fact is related to the effect of the marked enhance of the glutathione-S-transferase (the enzyme who stimulates covalent binding between glutathione and the toxic). In B III lot the enzyme activity was decreased and, consequently, reduced glutathione was enhanced. In the mantle there was no modification of these two parameters. The explanation of this observation is the connective tissue (more abundant in the mantle) and the lower cellularity than at gills. In the gills, the catalase and superoxide dismutase activity decreased in all 3 lots. In the mantle, catalase activity was normal in B I lot, enhanced in B II lot and decreased in B III lot. The superoxide dismutase activity was decreased in all 3 lots. In consequence, the gills are less resistant to the toxic influence than the mantle. The most sensitive parameter, at benzene intoxication, is superoxide dismutase.

**Keywords:** benzene, SOD, catalase, glutathione, oxidative stress.

### AIMS AND BACKGROUND

In the last 3 decades, the Black sea ecosystem was permanently damaged, and as a result, the bental communities has suffered.

The problem of chemical pollution is very important in the context of ecosystem protection. In this experiment our goal was to study the oxidative stress phenomenon in context of benzene intoxication on *Mytilus galloprovincialis*. Wang et al.<sup>1</sup> have shown the connection between production of the free radicals and benzene.

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\* For correspondence.

## EXPERIMENTAL

The biological material was 5-cm diameter mussels.

The experimental conditions were as follows: 50 l aquariums/lot, 20°C temperature of the sea water and 96-hour exposure to the toxic substance (benzene).

Experimental lots: Martor (M); B I – the animals were intoxicated with 0.057 ml benzene/40 l sea water; B II – the animals were intoxicated with 0.114 ml benzene/40 l sea water; B III – the animals were intoxicated with 0.224 ml benzene/40 l sea water.

The investigated metabolic parameters were reduced glutathione<sup>2</sup>, glutathione-S-transferase<sup>2</sup>, superoxide dismutase, catalase<sup>3</sup>. The investigated tissues were gills and mantle.

## RESULTS AND DISCUSSION

In the gills, benzene intoxication has produced marked modifications of the reduced glutathion content and the activity of glutathione-S-transferase in B II and B III lots. There was no effects in B I lot (Table 1). In B II lot the glutathione content decreased.

**Table 1.** Glutathione content, glutathione-S-transferase, catalase and superoxide dismutase activities in M, BI, BII, BIII lots of gills

Experimen- tal lots	G-S-transferase (U/mg prot.)	Glutathion (µg/mg prot.)	Catalase (U/mg prot.)	SOD (U/mg prot.)
Lot M				
$\bar{x} \pm se$	1.89±0.36	5.49±0.65	22.30±3.49	11.88±1.63
$n$	6	5	5	5
Lot BI				
$\bar{x} \pm se$	1.49±0.25	4.85±0.18	13.84±0.74	4.91±1.09
$n$	5	5	5	6
$t$	–	–	2.37	3.01
$p$	ns	ns	0.05	0.02
M%	–21.16%	–11.66%	–37.94%	–58.67%
Lot BII				
$\bar{x} \pm se$	2.89±0.29	3.73±0.11	12.24±1.43	1.38±0.19
$n$	6	5	5	6
$t$	2.16	2.69	2.79	7.07
$p$	0.05	0.05	0.02	0.001
M%	+52.91%	–32.06%	–45.32%	–88.38%
Lot BIII				
$\bar{x} \pm se$	0.89±0.08	7.50±0.17	13.36±2.12	4.38±0.91
$n$	6	5	5	6
$t$	2.74	3.01	2.9	4.21
$p$	0.05	0.01	0.05	0.002
M%	–52.91%	+36.61%	–40.08%	–63.13%

Note:  $\bar{x}$  – arithmetic mean,  $se$  – standard error,  $n$  – number of animals,  $t$  – the Student test,  $p$  – semnification limit.

This fact is related to the effect of the marked enhance of the glutathione-S-transferase (the enzyme who stimulates covalent binding between glutathione and the toxic).

This observation has been reported in the literature<sup>4</sup>.

In B III lot the enzyme's activity was decreased and, consequently, reduced glutathione was enhanced.

In the mantle there was no modification of these two parameters (Table 2).

The explanation of this observation is associated with the connective tissue (more abundant in the mantle) and the lower cellularity than in gills.

In the gills, the catalase and superoxide dismutase activity decreased in all 3 lots.

In the mantle, catalase activity was normal in B I lot, enhanced—in B II lot and decreased in B III lot. The superoxide dismutase activity was decreased in all 3 lots.

**Table 2.** Glutathione content, glutathione-S-transferase, catalase and superoxide dismutase activities in M, BI, BII, BIII lots of mantle

Experimen- tal lots	G-S-transferase (U/mg prot.)	Glutathion (µg/mg prot.)	Catalase (U/mg prot.)	SOD (U/mg prot.)
Lot M				
$\bar{x} \pm se$	1.06±0.15	6.89±0.46	22.26±2.96	16.36±2.23
<i>n</i>	6	6	5	5
Lot BI				
$\bar{x} \pm se$	0.98±0.08	7.01±0.39	32.68±4.11	6.98±1.86
<i>n</i>	5	5	5	5
<i>t</i>	—	—	—	3.23
<i>p</i>	ns	ns	ns	0.01
M%	-7.55%	+1.74%	+15.64%	-57.33%
Lot BII				
$\bar{x} \pm se$	1.03±0.2	7.6±0.81	33.82±0.32	4.47±1.11
<i>n</i>	5	6	5	5
<i>t</i>	—	—	2.21	4.77
<i>p</i>	ns	ns	0.05	0.001
M%	-2.83%	+10.30%	+17.69%	-72.68%
Lot BIII				
$\bar{x} \pm se$	1.06±0.21	9.23±2.03	15.33±1.61	10.44±0.94
<i>n</i>	5	5	5	5
<i>t</i>	—	—	2.21	2.44
<i>p</i>	ns	ns	0.05	0.05
M%	0%	+33.96%	-45.75%	-36.18%

Note. For explications see Table 1.

As a consequence, the gills are less resistant to the toxic influence than the mantle.

Our results are in accordance with the literature data<sup>5-7</sup>.

The most sensitive parameter, at benzene intoxication, is superoxide dismutase.

## CONCLUSIONS

1. The lower dose of benzene when the oxidative stress arose is 0.057ml/40 l sea water.
2. The gills are more sensitive than the mantle.
3. The most sensitive parameter is superoxide dismutase activity.

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