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INFLUENCE OF CUPRIC SULFATE ON ERYTHROCYTARY COMPONENT OF CIRCULATING BLOOD, IN *Carassius auratus gibelio* Bloch

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Key words: *Carassius auratus gibelio* Bloch species, cupric sulfate, erythrocytary volume, total haemoglobin, toxic anaemia

Abstract: Cupric sulfate determined in *Carassius auratus* species decreases of haemoglobin and erythrocytary volume favouring toxic anaemia.

INTRODUCTION

The exogenous chemical substances can induce some modifications at the level of circulating blood (globular or plasmatic compartment) and of haemopoietic organs.

The action of toxic substances on corpuscular blood compartments manifests as toxic anaemias. Their frequency increases concomitant with the number of noxes and of exposure possibilities.

The toxic anaemias are caused by several specific etiological factors: toxic agents on membrane, toxic agents which act at the level of globular enzymes and haemoglobin, sensitizing substances (some drugs). These agents primarily affect the erythrocytary series, but can induce, too, some modifications at the level of haemopoietic organs (medullary hypoplasias, pancytopenias with fat medulla, with a small number of cellular elements, the alteration of stem-cells division etc.), which induce aplastic anaemias.

All these facts are serious arguments to study the modifications induced by cupric sulfate on circulating erythrocytes (total haemoglobin and erythrocytary volume).

AIM OF INVESTIGATIONS

This paper has the aim to evidence the toxic valences of cupric sulfate on erythrocytary component of *Carassius auratus gibelio* Bloch species, exposed to various concentrations of cupric sulfate.

MATERIAL AND METHODS

Cupric sulfate in the salt of sulfuric acid, frequently used as hydrated form ($\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$). It is largely used in electrochemical industry (galvanic baths, electric piles) in chemical industry or in agriculture as antifungal. This compound arrives in surface running waters, as a result of residual waters throwing or by "washing" of agricultural fields.

The biological material used to test the toxicity of cupric sulfate was the young fish of *Carassius auratus gibelio* Bloch, one summer old, 85-100g in weight, and in very good morphophysiological state. For experiments, were used simple biotesting installations. Each experimental variant consisted in the exposure of 10 individuals at concentrations of 0.08 and 0.1 mg/l cupric sulfate, for 24, 48, 72 and 96 hours.

The determination of erythrocytary volume was conducted by Gussé micromethod, with graduated tubes. The results are expressed in percentages comparing with blood column height.

The quantification of haemoglobin was made by photocolometric method and the total haemoglobin is expressed in g/100ml blood.

RESULTS AND DISCUSSIONS

The alterations of sanguineous profile as reaction to the chemical stress determined the specialists in aquatic toxicology to study the blood morphological pattern. These investigations offer precise data relative to the influence of toxic chemicals on internal medium.

Our research evidences the modifications induced by $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$ on circulating erythrocytes and their functional element - haemoglobin, in *Carassius auratus gibelio* Bloch species.

The average values of erythrocytary volume in the groups of fish exposed for 24 and 48 hours at 0.08mg/l $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$ entered the limits registered for control (Table 1). After a 72 h exposure, the value of haematocyte diminished with 9% comparatively with control. For a 96 h exposure it was registered a severe decrease of erythrocytary volume (with 17.3%, comparatively to the control group).

The concentration of 0.1 mg/l $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$ determined a graduated decrease of erythrocytary volume, starting with the 48 h exposure, so that, at 96 h its value was $7.3 \pm 0.41\%$, thus with 18.2% smaller than control (Table 1, Graphic 1).

In the group treated with 0.08 mg/l and 0.1 mg/l concentrations of $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$ after a exposure time 24, 48, 72 and 96 h, the functional component of the erythrocytes, haemoglobin, registered significant quantitative modifications.

The first concentration (0.08 mg/l) determined the modification of quantity of haemoglobin after 72 h (the average value was with 1.5g% smaller than control average). A 96h exposure diminished haemoglobin amount with 4.5g % comparatively to control (Table 2, Graphic 2).

In individuals treated with a 0.1mg/l concentration of $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$ we observed a graduated decrease of haemoglobin amount for all the exposure times (24, 48, 72 and 96 hours) so that, at 96 h, the average value was with 5.8g% smaller than control.

The behaviour of the analysed erythrocytary parameters - total haemoglobin and haematocyte - at in *Carassius auratus gibelio* Bloch species, exposed for 24,48,72,96 h to two cupric sulfate concentrations (0.08 mg/l and 0.1 mg/l) consisted in severe diminutions of both parameters, in correlation with the concentration and exposure time to the tested compound.

The obtained results evidence modifications of the erythrocytary volume and total haemoglobin, in the sense of their decrease, fact that is favourable to the toxic anaemia starting. This disease determined even the death of several individuals 96 h exposed at 0.1 mg/l cupric sulfate. At young fish of *Carassius auratus gibelio* Bloch, exposed for 72 and 96 h to the 0.08 respectively 0.1 mg/l $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$, gills and mucous membranes bleeding was observed. This fact proves an acute haemolysis, probably accompanied by trombocytopenia.

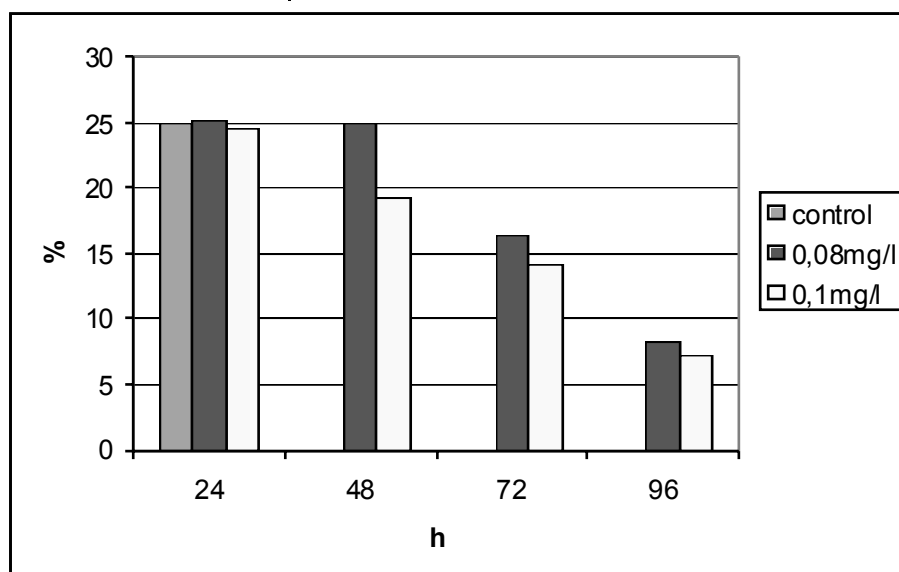
The cytotoxicity of ionizable salts of copper (cupric sulfate) is cited in literature (Christensen, 1972; Gentile, 1995; Mogos, 1990; Tsukia, 1979), as an essential etiological factor in installed toxic anaemia. It can also manifest the hypoxia induced by gills lesion or the medullar insufficiency in red cells production.

CONCLUSIONS

Cupric sulfate, in concentrations related to CL 50, determines, in offspring of *Carassius auratus gibelio Bloch* severe decreases of erythrocytary volume and total haemoglobin, causing toxic anaemia beginning.

Table 1. Modifications of erythrocytary volume in *Carassius auratus gibelio Bloch* species, under the influence of two concentrations of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

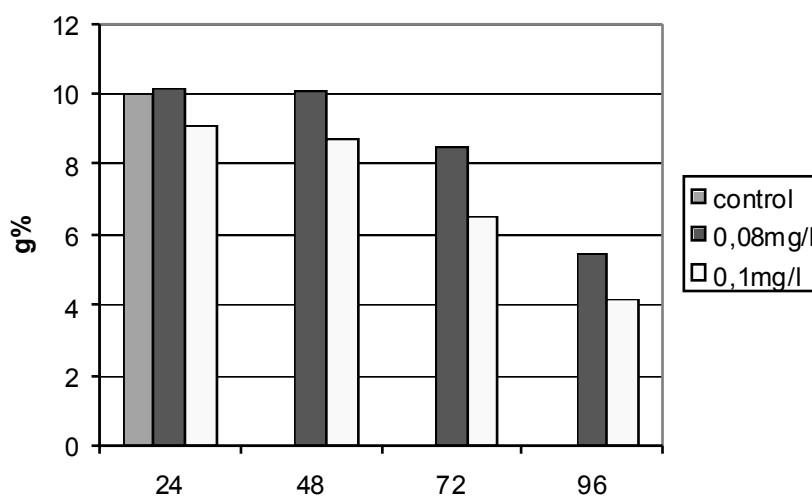
Exposure (hours)	Values of erythrocytary volume (%)	
	0.08mg/l $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	0.1mg/l $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
24	25.2±0.24	24.6±0.21
48	24.9±0.18	19.3±0.14
72	16.5±0.32	14.2±0.32
96	8.2±0.5	7.3±0.41
Control	25±0.25	



Graphic 1. Modifications of erythrocytary volume in *Carassius auratus gibelio Bloch* species, under the influence of two concentrations of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

Table 2 Modifications of total haemoglobin in *Carassius auratus gibelio Bloch* species, under the influence of two concentrations of $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$

Exposure (hours)	Values of total haemoglobin g%	
	0.08 mg/l $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$	0.1mg/l $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$
24	10.2±0.24	9.1±0.29
48	10.1±0.36	8.7±0.18
72	8.5±0.42	6.5±0.05
96	5.5±0.31	4.2±0.37
Control	10±0.21g%	



Graphic 2 Modifications of total haemoglobin in *Carassius auratus gibelio Bloch* species, under the influence of two concentrations of $\text{CuSO}_4 \cdot 5 \text{H}_2\text{O}$

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