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Toxicity of CuSO4.5H2O on Some Snails in Al-Shamiyah River, Al-Diwaniyah City

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Abstract: The toxicity of copper sulfate was tested as part of the current research ($CuSO_4.5H_2O$) as it impacts freshwater snails of three species. Species *Melanoides tuberculata*, *Melanopsis praemorsa*, and *Viviparus bengalensis* are chosen for conducting the current research. Stock solution of copper sulphate was prepared previously and series of concentrations were conducted and were 0, 0.3, 0.5, 0.7, 0.9, and 1 ppm. Then, the mortality of tested species were recorded at each intermittent periods and were 24, 48, 72, 96 hours, respectively of which death has been noticed and recorded. LC50 values were ranged between 0.21 to 0.41, as recommended for application in the farms. To conclude, copper sulphate is highly toxic to laboratory test organisms. More research in this regard should be taken into account in agricultural and environmental work and avoid excessive use of toxic substance as they are common pollutants to freshwaters such as rivers.

Keywords: Toxicity, CuSO4.5H2O, copper sulfate.

RESEARCH PAPER

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1. INTRODUCTION

It has been stated that pollution by heavy metal of aquatic ecosystems is a significant issue for environmental worldwide. Due to certain species are tolerant, the pollutants accumulate and harm organisms by moving up the food chain (Aksoy *et al*., 2005). One of the most toxic heavy metals is Copper sulfate and widely used in different agricultural aspects such as in manage fungus pests in different crops (Jalali *et al*., 2018). Moreover, Murray-Gulde *et al.*, 2002 have stated that $CuSO_4$ has been used as an algicide in controlling alien aquatic plants, the roots of plants nearby water lines. When Copper sulfate reaches specific amounts, it is said to have an toxic impact on both land and water dwelling species (Rehman *et al*., 2019; Banaee *et al*., 2024). Negative effects such as histological alterations in tissues of the freshwater snails (Nica *et al*., 2013; Otludil and Ayaz, 2020). Thus, freshwater snails has been used in toxicological studies to assess the ecological status of water bodies as freshwater snails act as good biological indicators of water pollution. Species such as *Physa acuta* and *Viviparous bengalensis* have been utilized in toxicological studies (Al-Jasimee *et al*., 2019; Otludil and Ayaz, 2020). Thus, the current work's purpose is to investigate the a cut test of copper sulfate against three species of freshwater snails and they are *Viviparus bengalensis*, *Melanopsis praemorsa* and *Melanoides tuberculata*. To ascertain the potential applied use of $CuSO_4$ in the agriculturally surrounding freshwaters without harmful effects on other economic species.

2. MATERIALS AND METHODS

2.1 Sample Collection

To gather as many of the three freshwater snails as possible, individuals of snails were manually collected from Al -shamiyah River, branch of Al-Diwaniyah River. Individual snails were then moved to big plastic containers filled with a river of water. Snails were cleaned in the lab to obtain clear of debris and clay. Snails were then moved to a 20-liter tank and exposed to 12 hours of darkness and 12 hours of light. After being fed by the *Ceratophyllum dimerism* plant, the snails stayed without food for 48 hours.

2.2 Preparation of Toxicity Test Solution

One milligram of copper sulfate was weighed and then dissolved in one liter of distilled water to provide a stock solution for the toxicity test. A series of diluted concentrations of the stock solution, specifically 0, 0.3, 0.5, 0.7, 0.9, and 1 ppm, were prepared. Six individuals of each snail were placed in containers with the prepared concentrations (five duplicates of each

concentration), with a control group consisting of 0 concentration. After carrying out several tests and obtaining suitable concentrations, the experimental concentrations were selected. When snails were exposed to acupuncture needles, their cease-movement was seen as a symptom of their mortality. Using the Probit Unit analytical method, the toxicity of copper sulfate was measured by estimating the LC_{50} after 96 hours of exposure. The probability values determined by equation were obtained using the regression equation:

$Y = a + b X + e$

Where:
Y: Calculated probability value.
b: Regression value.
X: The value of the logarithm of concentration.

3. RESULTS AND DISCUSSION

Tables (1, 2, and 3) show the percentage of mortality of the three species of snails that are *Melanoides tuberculata*, *Melanopsis praemorsa*, and *Viviparus bengalensis* (figures 1, 2, and 3) which exposed to different concentrations of copper sulphate. The majority of copper sulphate concentrations had significant consequences within 96 hours, according to the results. The findings showed that there were no mortality in 0 concentration which represented control concentration. Similarly, 0.3 ppm concentration did not record death with species *Melanoides tuberculata* at first 24hrs, in contrast to species *Melanopsis praemorsa* with percentage of death 50%, and 83% for species *Viviparus bengalensis*.

After 24, 48, 72, and 96 hours of exposure to copper sulfate, the average values of the half lethal concentration of half the experimental animals (LC50) were ranged between 0.21 to 0.41 of 96hrs of exposure with species *Melanoides tuberculata* (Table 4). While for species *Melanopsis praemorsa*, the LC_{50} was ranged between 0.18 to 0.41, whereas species *Viviparus bengalensis* recorded LC_{50} fluctuated between 0.31 to 0.41.

Table 1: *Melanoides tuberculata* mortality rate after 96 hours of exposure

Concentration ppm / Time of Exposure	24	48	72	96
0	0	0	0	0
0.3	0	50	100	100
0.5	17	67	100	100
0.7	17	50	100	100
0.9	0	100	100	100
1	0	50	100	100

Table 2: *Melanopsis praemorsa* mortality rate after 96 hours of exposure

Concentration ppm / Time of Exposure	24	48	72	96
0	0	0	0	0
0.3	50	67	100	100
0.5	100	100	100	100
0.7	100	100	100	100
0.9	83	100	100	100
1	100	100	100	100

Table 3: *Viviparus bengalensis* mortality rate after 96 hours of exposure

Concentration ppm / Time of Exposure	24	48	72	96
0	0	0	0	0
0.3	83	100	100	100
0.5	100	100	100	100
0.7	100	100	100	100
0.9	100	100	100	100
1	100	100	100	100

Table 4: LC_{50} values for copper sulphate of studied snails

Melanoides tuberculata				
Time	24	48	72	96
LC_{50}	0.21	0.20	0.41	0.41
Melanopsis praemorsa				
Time	24	48	72	96
LC_{50}	0.18	0.22	0.41	0.41
Viviparus bengalensis				
Time	24	48	72	96
LC_{50}	0.31	0.41	0.41	0.41

Figure 1: ***Viviparus bengalensis***

Figure 2: ***Melanoides tuberculata***

Figure 3: ***Melanoides tuberculata***

According to Prentera *et al*., (2004), finding a pesticide or pollution tolerance or low risk level in water bodies is thought to be greatly aided by computing LC_{50} values. From table (4), it is noticed that LC50 values are increased over the time of exposure, and showed positive relationship with percentage of death, so that the current study is in consistence with (Otludil and Ayaz, 2020) in Turkey and with (Farid, 2005) in Iraq. Cu $(NO_3)_2$. $3H_2O$ 13.3 ppm and 16.1 ppm for *Lymnae aurticularia* and *Theodoxus jordani*, correspondingly, The Cu $(NO_3)_2$. $3H_2O$ LC_{50} that the author recorded is in 24 and 48 hours.

The approach used by these snails to avoid harmful compounds like copper sulphate may be the source of the variation in the documented mortality time of snails. The strategy involves adhering to the test basin walls or, as a safety measure, withdrawing into their shells as noticed in the current study. On the other hand, post-synaptic nicotinic acetylcholine receptors (nAChRs) are inhibited by copper sulphate, which has the harmful consequence of weakening nerve signals and preventing ions from entering neurons (Fowler and Maples-Reynolds, 2015).

4. CONCLUSION

In summary, this study strongly suggested that snail control with copper sulphate should only be carried out at prescribed copper sulphate concentrations. This is to prevent the other economically important biota, such fish and plants, from dying. Since copper sulfate is poisonous and pollutes freshwater biota, agricultural organizations along with other research facilities should assume responsibility for educating farmers about using this substance to control invasion of snails.

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