

**TOXICITY OF HEAVY METALS AND
EFFECT OF THEIR
CONCENTRATIONS ON BIOLOGICAL
PRODUCTIVITY AND DIVERSITY IN
FRESHWATER ECOSYSTEM**

BY

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PRESENTATION OUTLINE

- **Introduction**
- **Methodology**
 - **Mortality studies**
 - **Toxicity studies**
 - **Biological productivity**
- **Results & Discussion**
- **Conclusion**

INTRODUCTION

- **Modern industrial technologies use heavy metals both in the elemental and combined forms.**
- **In recent years, serious concerns have been voiced about the deteriorating state of fresh water bodies with respect to trace metal pollution.**
- **It is recognized that in freshwater systems, trace metals have high pollution potential that could be measured through the use of fish.**
- **The results of researches with fishes indicate that metal distributions in fishes are both species-specific and site-specific.**
- **Heavy metals have also been shown to have the potentials to be toxic to living organisms if present at a level above a threshold, which varies between taxa, probably even at the specific level.**

INTRODUCTION CONTD

- **A number of human activities have been identified through research to impact on biological productivity in fresh water ecosystems either positively or negatively**
- **Some of such activities include:**
 - **Oil & gas exploration and production,**
 - **dredging,**
 - **road and bridge construction,**
 - **urbanization,**
 - **indiscriminate use of fertilizers and pesticides on agricultural lands,**
 - **industrialization,**
 - **indiscriminate waste dumping and filling of wetlands, amongst others.**

INTRODUCTION Contd

- **In this research, *tilapia guinensis*, a biological monitoring test species was used to assess the heavy metal toxicity.**
- **This research on the toxicity of heavy metals and effect of their concentrations on biological productivity and diversity in freshwater ecosystem was designed using three heavy metals (Cu, Fe, Pb) separately, to show the effect of these metals on biological productivity in a static simulated study**

MATERIALS AND METHODS

- **Preliminary tests to determine the survivability of *tilapia guinensis* in graded concentrations of the same heavy metal solutions were carried out.**
- **Copper (Cu), iron (Fe) and lead (Pb) solutions were used.**
- **Mortality of fishes with time was determined for each of the heavy metal concentrations and control.**
- **In each test, 10 fish samples were exposed in a tank containing 20L of test solutions with different concentrations of the heavy metals. The control did not contain any trace of the heavy metals.**
- **Observations for mortality were made hourly at regular intervals. Dead fishes were removed at each observation and percent mortality was calculated for the heavy metal concentrations selected for the mortality studies. This was repeated for each of the heavy metals.**
- **The test lasted for 96 hrs.**
- **From the observations made, it was possible to select four concentrations for the heavy metal toxicity studies.**

MATERIALS & METHODS Contd

Toxicity Studies to Determine the LC₅₀

- **Aerated aquaria used in this toxicity studies were similar to those described by Ahsannulah.**
- **All tests were static and were conducted in accordance with the recommendations of Spraque.**
- **In each experiment, a control (distilled water), and graded concentrations of the test heavy metal were used. In each test, 10 fish samples were exposed in an aerated tank containing 20L of test solutions.**
- **Observations for mortality were made hourly at regular intervals. Dead fish samples were removed at each observation. A total of 50 fish samples were used at each round of test (40 fish for test and 10 for control).**
- **This was repeated for each of the heavy metals.**



Photograph of Tilapia fish used for the toxicity study

MATERIALS AND METHODS

Biological Productivity

- **Selected solutions of the Cu, Fe and Pb heavy metals were used in static simulation studies.**
- **Mortality and toxicity studies were each carried out for 96 hours.**
- **The period for the toxicity studies was extended to 168 hours (7 days).**
- **Test solutions were observed for any effect due to the heavy metals in solution.**
- **The test was also extended for 14 days for observed effects to be more obvious.**

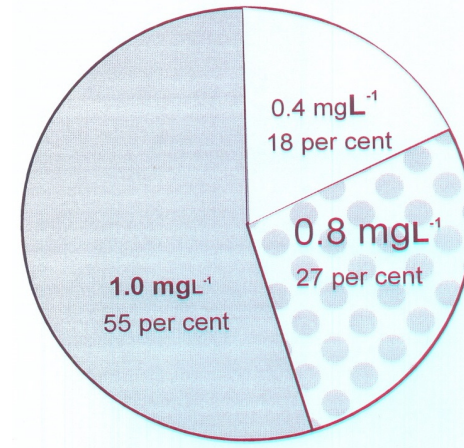
RESULTS & DISCUSSION

PERCENT MORTALITY

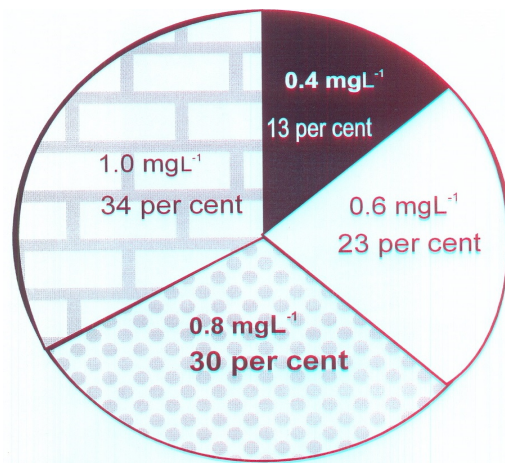
Percent mortality of fish in the different tested heavy metal solutions are shown in figures.

It was generally observed that mortality was increased as the concentrations of the different heavy metals were increased.

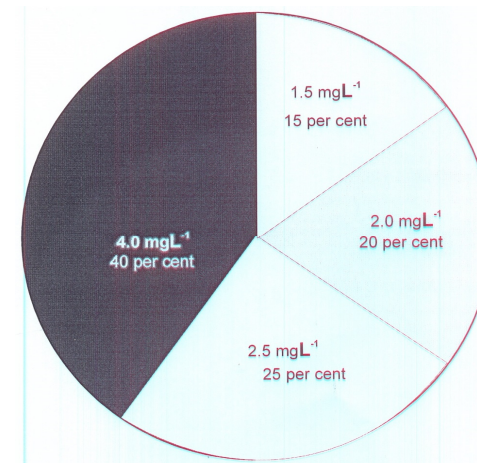
Fe



Cu

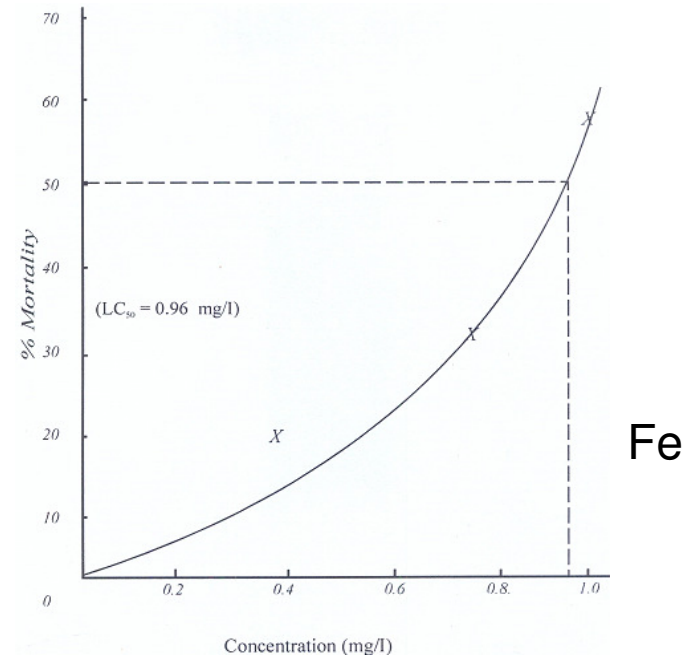
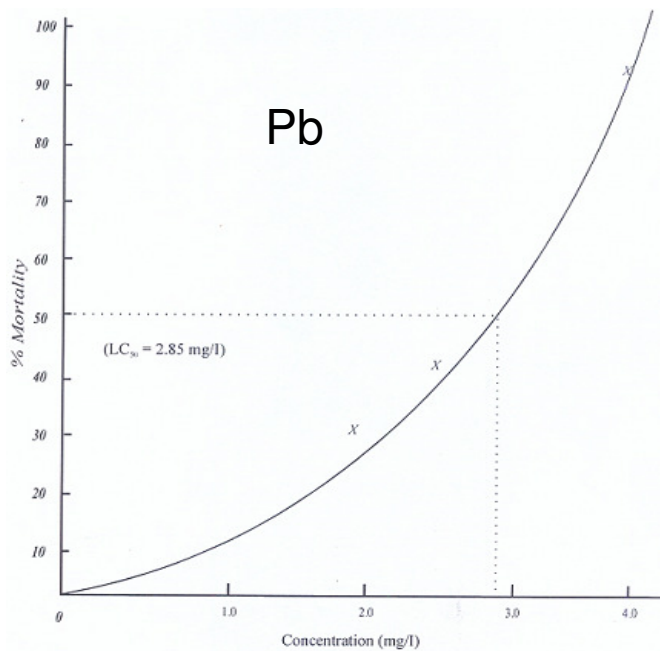
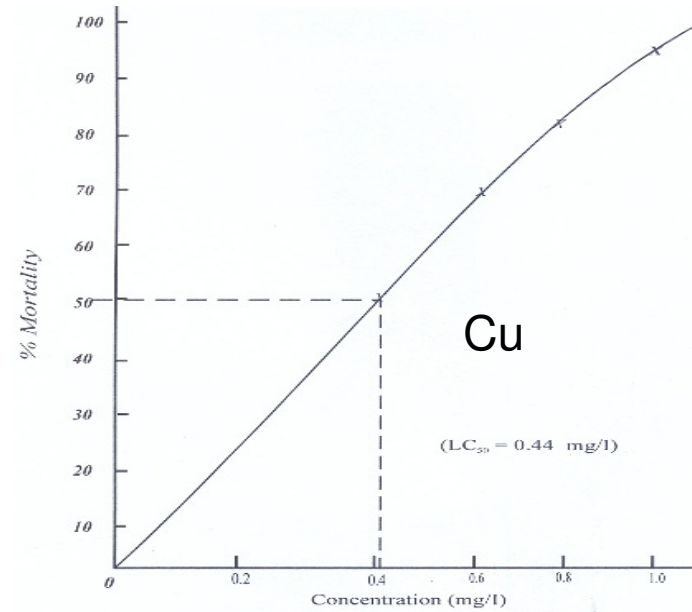


Pb



TOXICITY STUDIES

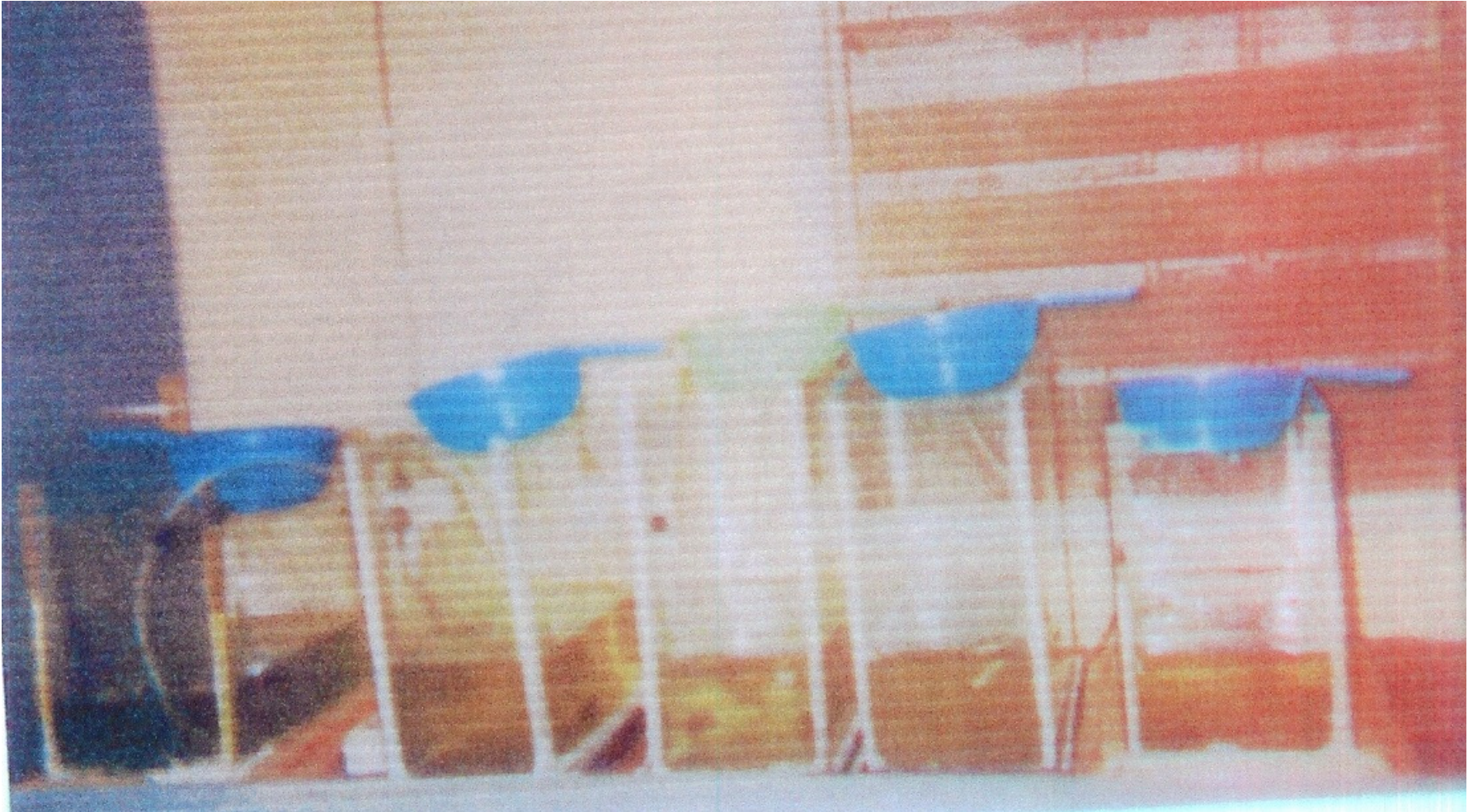
The LC_{50} obtained for the toxicity study for Pb, Fe and Cu in the simulated study were 2.65mg, 0.85 and 0.35mg/L respectively as shown



BIOLOGICAL PRODUCTIVITY

- **Evidence of increased biological productivity was seen as the toxicity study lasted for 96 hours. This was most observable in the aquarium containing 2.65mg/l of lead.**
- **This observation became only obvious in the aquaria containing 0.35 and 0.85 mg/l for Cu and Fe, respectively, as the time of the experiment was extended from four (4) to fourteen (14) days.**

THE EXPERIMENTAL SET UP SHOWING GRADATION IN COLOUR AS EVIDENCE OF EUTROPHICATION



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14

CONCLUSION

- **It can be concluded that heavy metals support biological productivity in fresh water ecosystems and the degree differs from one metal to the other as was evident in the study.**
- **Regular bioassay, a test involving living tissues should be conducted in organisms or groups of organisms to determine the potency of any physiologically active substance of unknown activity.**
- **These tests have been used to ascertain effects such as toxicity, bioaccumulation, histopathology, growth rate, mutagenicity, embryo toxicity and teratogenicity.**

THANK YOU