# Toxicity of Fresh Radiographic Developer on Tadpole of *Rana subsigillata Species*

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**ABSTRACT**

Toxicity of fresh radiographic developer on tadpole of Rana subsigillata species collected from drains in Calabar was examined. The eggs of these amphibians were collected and hatched in the laboratory within 48 hours with about 99% tadpole survival. They were acclimated in about 400ml of tap water for 24 hours. A total of forty (40), 3 day old tadpoles were used. Range finding test was conducted at toxicant concentrations of 1% - 10% and control (0%) in the stock test (200ml) was sub sampled and transferred into each of the test concentration. This includes 200ml of the control containing only tadpoles and water. They were observed for hyperactivity and death of the organisms within 24 hours. High concentration of 10% indicated complete death of all the organism after 30 minutes of exposure to the developer. Maximum concentration of 0.9% was used for the toxicity testing. Other concentrations used for the toxicity testing were 0.3%- 0.8% and (0%) control respectively. There was increase death of tadpole as toxicant concentration increases from 0.6 – 0.9% with increased duration of the exposure. Maximum exposure time was 96 hours while estimated 96 hr LD50 is 0.46 ± 0.22 of which safe disposal limit (approximate) was 0.046. Considering the vital part of tadpole in the ecosystem, it becomes pertinent, therefore, that legislations, policies and sanctions be put in place to ensure safe disposal limit and adherence to laws on radiographic developer effluent disposal in Nigeria.

## INTRODUCTION

The attention and services of the x-ray departments are required in hospitals. These services ranges from presurgical to post surgical examinations for accident and emergencies, paediatrics, ward as well as routine cases [1]. The end product of the radiographic process is a radiograph. The latent image can be made visible by chemical processing in a developer [2].

In a bid to meet millennium development goals, one of which is health Nigerian government embarked on massive revamping of her health sector [3]. These includes provisions of radiographic equipments, such as computed tomography (CT) scanners, Magnetic Resonance Imaging (MRI) scanners, ultrasound scanners and state of the art conventional x-ray machines with manual and automated film processors. This was occasioned by the poor ranking of Nigerian health sector by WHO (1999) World Health Organisation [4]

Adequate data on developer effluents produced in Nigeria is lacking. A preliminary survey on the developer consumption level in radiography and photography centres in Calabar, Cross River State, Nigeria, puts the developer effluent production at approximately 16,000 liters annually. In Nigeria, radiographic developer effluent are usually disposed of by discharge into hospital and public drains and their end destination is into water bodies (streams and rivers) etc. its ecotoxicity is generally high (<1mg/litre of aquatic organisms) and vary from species to specie within the same taxonomic group. The sensitivity of different species to hydrogunione (developers) may vary by factors of 1000. [5]. Studies showed that the chemical had high toxicity to several species at low concentration. During the wet season, most drains contains temporary pools of water and become suitable habitats for the amphibians (toads and frogs) and serves also as their breeding ground. These are important in both terrestrial and aquatic food web.

This paper intends to investigate the response of tadpole – Rana subsigillata to developer effluent, the results of which will be of importance in environmental management.

## 2. Materials and Methods

Test organisms (tadpole eggs) were collected from drains in Calabar. The eggs were left in the habitat water in the laboratory to hatch. The eggs hatched within 48 hours with more than 99% tadpole survival. The young tadpoles were transferred to tapwater in glass beaker and acclimated for 24 hours using approximately 400ml of water.

Range finding, test was performed on the organisms to determine appropriate range of concentration for the toxicant. Toxicant concentration of 1% and 10% were prepared in 100ml of water.

The toxicity test was conducted using the concentration, 0.3%, 0.4%, 0.5%, 0.6%, 0.7%, 0.8% and 0.9% (control). The organisms used for the toxicity testing were three (3) day old and ten (10) organisms each was used for the different concentrations.

Estimation of the mean of effective lethal dose was performed using Spearman Karber method [6]. Effective lethal dose for 96 hours was calculated using the formula.

96hrs$LD_{50}$ M= xk – d (S- ½)

where $LD_{50}$ or M— Mean Effective lethal dose

Xk— largest test dose which produces 100% mortality (reaction)

d — difference between adjacent doses

$S_1$ - Sum of the relative portions of each reacting organisms

$S_2$— Sum of the cumulative added portions of the reacting doses.

## 3. Results

96hrs$LD_{50}$ M= xk – d(S- ½)

where M = 0.46

Calculating the standard deviation associated with this 96hr$LD_{50}$

*Table 1: Result of Toxicity Test after 96 Hours of Exposure*

| % / hours | 24 hrs | 48hrs | 72hrs | 96hrs |
|---|---|---|---|---|
| 0% | 0 | 0 | 0 | 0 |
| 0.3% | 13.30 | 20.00 | 23.30 | 36.67 |
| 0.4% | 16.67 | 26.67 | 36.67 | 53.33 |
| 0.5% | 26.67 | 46.67 | 56.67 | 66.67 |
| 0.6% | 33.33 | 50.00 | 60.00 | 70.00 |
| 0.7% | 43.33 | 56.67 | 66.67 | 73.33 |
| 0.8% | 73.33 | 86.67 | 86.67 | 90.00 |
| 0.9% | 83.33 | 96.67 | 100 | 100 |

S$LD_{50}$ sm=

*Table 2: Calculation of $LD_{50}$*

| Concentration | % death of tadpole | Relative portions | Cumulative relative portion of tadpoles death |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0.3 | 36.67 | 0.3667 | 0.3667 |
| 0.4 | 53.33 | 0.5333 | 0.9000 |
| 0.5 | 66.67 | 0.6666 | 1.5666 |
| 0.6 | 70.00 | 0.7000 | 2.2666 |
| 0.7 | 73.33 | 0.7333 | 2.9999 |
| 0.8 | 90.00 | 0.9000 | 3.8999 |
| 0.9 | 100 | 1.0000 | 4.8999 |
| D = 0.1 | | S1 = 4.8987 | S2 = 16.8996 |

SM = 0.22 = 0.46 ± 0.22

$$d\sqrt{2(S_2) - S_1 - S_1^2} - \frac{1}{12}$$

## 4. Discussion

The results obtained from the experiment (table 1) indicate that the percentage mortality of tadpole (Rana subsigillata) is not very conspicuous at exposure duration and toxicant concentration of 24-48 hours and 0.00 – 0.30% respectively. At high effluent concentration of 0.6 – 0.9% there exist a marked difference in the percentage mortality between 24-96 hours that is 33.33% - 83.33% and 70.00% - 100% respectively. Thus, it could be deduced that the potential for harm is more at higher concentration of the toxicant (fresh developer). Toxicant concentration of 0.9% of exposure produced very lethal effects within a short time of exposure.

Table 2 shows the value of 96 hours LD50 on this study as 0.46±0.22. This implies that 50% mortality of R. subsigillata was recorded at 0.46% toxicant concentration.

Based on the observations and results obtained from the experiment, it was deduced that fresh radiographic developer is toxic to tadpoles. The calculated 96 hours $LD_{50}$ is 0.46 ± 0.22. According to [7] and [8], the estimated safe discharge limit of fresh developer is therefore $1/10^{th}$ or 10% of the LD50 (0.046). Consequently, there is need for adequate legislations on radiographic developer disposal stating the safe discharge limits.

## References

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