

Determination of Barium Levels in Soft Muscle Tissue of Niger Delta Mudskipper, *Periophthalmus barbarus* (L) Using Buck Scientific Atomic Absorption and Emission Spectrophotometer 200A (AAS)

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Abstract: A study of the determination of the uptake of barium levels in soft muscle tissues of Niger Delta Mudskipper, (*Periophthalmus barbarus*) were analyzed using Buck Scientific Atomic Absorption and Emission Spectrophotometer 200A (AAS). The values obtained ranged from 22-510 $\mu\text{g/g}$. Statistical analysis showed no significant difference ($p < 0.05$) with respect to percent concentrations and uptake levels of barium. Generally, it was observed that as concentrations increased, the levels of barium uptake increased progressively in the soft muscle tissues of the exposed experimental fish.

Keywords: Bioaccumulation, drilling fluid, macro-fauna, toxicity, uptake

INTRODUCTION

Buck scientific atomic absorption and emission spectrophotometer (AAS) in present day analytical techniques are used for the determination of barium levels. This has been applied in the determination of barium level in the soft muscle tissue of *P. barbarus*. Analysis using AAS revealed that drilling fluids (suspensions of solid in liquid) contain additives (barite) which are complex mixture of highly volatile materials and toxic substances such as heavy metals, hydrocarbons and organic compounds (Mohammed, 2010). An exploratory study into the effectiveness of barium combination of drilling fluid components has been carried out by Cobby (2002). According to Patin (1999), the eco-toxicological hazard of barite and lignosulfonate has been investigated. However, the most toxic drilling muds are those that contain high concentrations of hexavalent chromium, diesel fuel or surfactant (Neff, 1987). Wills (2000), reported high heavy metal content observed in the area around drilling platforms. Which is in support of the findings by James *et al.* (2000), Odiete (1999) and PAS (Pollution Assessment Study) (1995). Morton (1987) demonstrated that high concentration of barium and chromium obtained from drilling fluid in the Sea-grass macro-fauna was a clear indication of bio-accumulation. In addition, EPA (1999), reported barium concentrations in the sediments of the Western Gulf of Mexico ranging from 800 to 14,670 mg/kg after 24 months. The present study was carried out in the laboratory to investigate the levels of barium content from oil-based drilling fluid on Niger Delta Mudskipper (*P. barbarus*).

MATERIALS AND METHODS

P. barbarus of various weights and sizes were collected using a trap net at low tide from the mangrove shores of Rumuche River in Emohua Local Government area, in Port Harcourt, in the Niger Delta. The fish were transported in the late hours of the day to the Hydrobiology/Fisheries Biology laboratory, University of Port-Harcourt and in the laboratory where the experiment was carried out, they were sorted out into different sizes after initial length and weight measurement had been taken. The fish were conditioned for one week and were fed with feed (meal) obtained from the African Regional Aqua cultural Centre, ARAC. After a 4 day exposure to obtained concentrations of oil-based drilling mud, the soft muscle tissues were removed, measured and weighed immediately. The soft muscle tissue of about 0.67 g was then dissected and homogenised in a mortar which was digested with a (3:1 v/v) H_2SO_4 and HNO_3 mixtures. The digest was placed in crucibles in a system chamber (Model 567/98) for 4 h. The reagents used in the preparation were standards and the stock solutions were prepared and analyzed. Blank samples were run simultaneously with the prepared samples. In order to ensure accuracy and reproducibility of analytical data, duplicate analyses were conducted for each batch of

Table 1: Barium levels in *P. barbarus* soft muscle tissues ($\mu\text{g/g}$)

Concentrations (%)	Uptake of barium levels
Control (0%)	21.70 \pm 1.57
2	99.00 \pm 1.00
4	406.67 \pm 11.55
8	410.00 \pm 17.32
10	705.00 \pm 5.00

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Table 2: ANOVA on *P. barbarus* after exposure to oil-based mud for 4 days

Source of variation	SS	df	Ms	F	p-value	F-crit
Rows	252.6813	2	126.3407	1.506465	0.278451	4.458970
Columns	941892.6	4	235473.2	2807.742	1.28E-12	3.837853
Error	670.9253	8	83.86567			
Total	942816.2	14				

sample and the control. Barium determination was prepared from the digest by dissolving 0.3215 g BaSO₄ in water and made up to 1 L. The appropriate wavelength was selected as the air and gas flow were adjusted to standards. A calibration curve was prepared from the standard readings and barium concentration was obtained.

RESULTS

The means and standard deviation of barium content in the soft muscle tissue of *P. barbarus* are presented in Table 1. While Table 2 shows the analysis of variance of barium for *P. barbarus*.

DISCUSSION

Fish may be directly affected by the uptake of oil via water contaminated sediments and food materials. Ingestion of oils from contaminated food is more common than coating which affects survival of fish (Carls *et al.*, 1996). Bioaccumulation of barium in the test fauna (*P. barbarus*) are generally related to oil concentration on the treatment tanks. Barium content in tissues of 2, 4, 8 and 10%, respectively were above the concentrations found in the control fish of the experiment. As observed in this study, uptake of barium levels increased progressively with concentrations. The use of barium as an additive in the preparations of drilling fluids in the oil industry will need proper care because of the active uptake by aquatic fauna and can be transferred directly upon consumption to humans. These findings are in line with reports by Davies and Pirie (1980), that barium are carcinogenic and accumulative. Therefore, eventual consumption of contaminated fish exposed to drilling fluid discharges by man could pose health hazards especially to pregnant mothers and children. This result is in line with the observation of other workers for Crab (Hart *et al.*, 2007), Periwinkle (Hart and Ulonnam, 2008), Snails (Benka-Coker and Ekundayo, 1995) and Crocodiles (Ekpubeni and Ekundayo, 2004).

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