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ORGANOCHLORINE PESTICIDES DETERMINATION OF ISELEGU WETLANDS FOR CAGE AQUACULTURE IN SECONDARY SCHOOLS AS A RECIPE FOR REMODELING EDUCATION IN NIGERIA

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Abstract: **This study was an ex-post facto research that investigated the content of organochlorine pesticides in Iselegu wetlands for its suitability for cage aquaculture deployment. The study answered 3 research questions and tested a hypothesis. To achieve these, Iselegu wetlands were mapped out into 5 research sampling blocks and water samples were collected from 5 spots in each block bulked and composites drawn and fixed with HNO_3 and stored in ice cool box for analysis. The analytical standard employed was USEPA 3570 and the instrument of determination of the pesticides deployed was Agilent 7820A GC. The results obtained were as follows; adrin 0.60±0.07µg/l, diedrin 0.12±0.09 µg/l, edrin 0.15±0.06 µg/l, DDT 1.90±0.39 and heptachlor 0.28±0.06 µg/l. The mean results of the pesticides investigated were subjected to test of significance using SPSS model 29 at 0.05 level of significance. The *p* value was 0.42 thus rejecting H_o. The study concludes that the wetlands are polluted with organochlorine pesticides above critical point and recommends that cage aquaculture should not be deployed in the wetland, pollution source points should be identified and plugged, farmers should be educated on safe pesticides use and the impacted wetlands should be remediated.**

Keywords: **wetlands, cage aquaculture, organochlorine pesticides, bioaccumulation, human health.**

1. INTRODUCTION

Education is the major tool for unlocking economic growth potential of any country and for it to continue play this key role, the educational system must be subjected to constant remodeling. Remodeling is to review, reshape to be in tune with the changing situations. Shedrack (2018), Jackson (2019) see remodeling as to restructure, retool and regig. It is to re-orientate for better goal achieving ability. Remodelling is the act of altering the existing style, it is changing the form of a thing (Benson, 2019, Johnson, 2019, Samuel, 2020). Remodelling is to alter, it is to remould (Dell, 2019). It is to give a new shape, a new look (Betrand, 2018). Remodelling is subjecting an organization or processes to structural reorganization, rearrangement (Collins, 2016, Joel, 2018). It is a system overhauling, renewal and recasting to suit the prevailing situation (Spencer, 2017, Kenneth, 2018). Educational system policy remodeling is to change education curricular to be in term with

global changes in science, information technology and economic engineering (Franklin, 2018, Jubril, 2019, Stanley, 2020). Abdulai (2020), Okonkwo (2021) opined that Nigeria educational system needs remodeling from scholarship to technical, vocational and entrepreneurial. This view was reiterated by Ogagaoghene (2021). Odagwe (2019) that the current educational curriculum in Nigeria has to be remodeled to suit the country's aspiration for technological growth and job creation.

Nigeria is currently bedeviled with scourge of unemployment with the unemployment rate as at the last quarter of 2022 put at 40.10 percent (National Bureau of Statistics (NBS), (2023), International Labour Organisation (ILO), 2022) revealed that the rate of unemployment in Nigeria is 40.3 percent while International Monetary Fund (2022) put the unemployment rate in Nigeria at 40.5 percent.

Agunbiade (2020), Kashim (2020) Ioyem (2021) enjoined Nigeria youths to embrace vocational and entrepreneurial skills acquisition for employment and job creation. In the same vein, Bamgboye (2022), Osokogwu, (2020) admonished Nigeria government to encourage the youths to go into aquaculture to create job, reduce unemployment and save foreign exchange on fish importation.

Nigeria fish demand is 1.1 million tonnes while the local production of fishery and aquaculture is 800,000 metric tonnes (Ruwani, 2022, Oteriba, 2023). Ogwu et al., (2021) advised secondary schools management to educate and encourage youths to venture into aquaculture deploying cage due to its low capital outlay. Cage aquaculture according to Ogwu et al., (2022), Bamgboye (2022) is the act of raising fish and other aquatic organisms in a cage anchored in a natural body of water. Osadolor, (2022) advised that water analysis be conducted on the body of water to be utilized for cage aquaculture for the presence of toxicants to avoid bioaccumulation and biomagnification. Probable water pollutants as highlited by Atshana and Atshana (2012), Ogwu (2021) include, microplastics, detergents, polyaromatic hydrocarbons (PAHs), dioxins, furans, heavy metals, pesticides such as carbamate, organophosphates and organochlorines. Organochlorine are compounds with carbon and chlorine atoms that are utilized in pesticides formulation and are known to be resilient to degradation. (USEPA 2012, Ogwu, 2021, World Health Organisation 2018). Bioaccumulation according to United State Environmental Protection Agency (2015) is the propensity of toxicants within aquatic environment to penetrate into organisms tissues while bioamagnification is the ability of the toxicants to multiply in geometry once in the organisms.

The health implications of consumption of organochlorine contaminated foods in humans include lung cancer, bone degeneration, cardiovascular disease and memory problems (USEPA, 2012, WHO, 2018, Ogwu, 2020). Wetlands according to Ransar (1971) Ogwu et al., (2021), Bamgboye (2022) are ecological areas with the ability to hold water for atleast 3 months in a year.

The focus of this study is the assessment of organochlorine pesticides content of Iselegu wetlands Delta state for its suitability for cage aquaculture in secondary school, for job creation and poverty alleviation and as a veritable tool for remodeling education

The organochlorine pesticides investigated are adrin, diedrin, endrin, dichlorodiphenyltrichloroethane (DDT), and heptachlor.

The study was guided by research questions as below:

1. what are the concentrations of adrin, diedrin, endrin, DDT and heptachlor in Iselegu wetlands in.

2. are the concentrations of the organochlorine pesticides within the maximum permissible limits stipulated by WHO 2014.

3. can cage aquaculture be deployed in Iselegu wetlands.

Hypothesis

The study is guided by a hypothesis as below:

H_o: there is no significant difference between the concentrations of the organochlorine pesticides investigated in in Iselegu wetlands and WHO maximum permissible concentration for organochlorines pesticides in water.

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Study Area

Figure 1: Map of Iselegu

Source: https://nona.net/features/map/placedetail.2248124/Iselegu/

Iselegu is a littoral community in Ndokwa East local government area., Delta state, Nigeria. It is located at geographical coordinates of latitude 5.8365N ° and longitude 6.4703°E with a land area of 37,657m^2 and a population of 1426 inhabitants (National Population Census (NPC) 2006). The people are predominantly farmers and fishermen with some of them in petty trading, some of the inhabitants are artisans while a few of them work as civil servants as teachers in public primary and secondary schools. Iselegu is flanked at the north east by a river named Iselegu River with a stretch of wetland as the watershed. The wetlands and the river are the recipients of pesticides and fertilizers utilized in the farms for weed and other pest control measures through erosion, run offs and flash floods.

2. MATERIALS AND METHODS

Iselegu wetlands were mapped out into 5 sampling blocks A, B. C, D, E (Abdulsaheed, 2019). From each of the sampling blocks water samples were collected with clean plastic sampling bottle at the depth of 10cm from 5 spots, bulked with composites drawn and fixed with nitric acid and stored in the ice cool boxes for analysis.

Analysis

United States Environmental Protection Agency (USEPA) procedure 3570 as described by Ozil (2018) was adopted. 5ml of wetland water from each research block were measured out into beakers and 2gm of anhydrous sodium sulphate were added and thoroughly mixed. The mixtures were later transferred into clean extraction flasks with cap and allowed to stand for 30 minutes. 20 gm of decaflourobiphenyl were then added to the flasks with $NaSO_4$ mixture and the tube vigorously shaken to the point when slurry will be free flowing. The flasks were then allowed to settle for 30 minutes. The organochlorine pesticides were determined with the extracts using Agilent 7820A gas chromatography method.

3. RESULTS

The results of the organochlorine pesticides in Iselegu wetlands are as in Table 1.

Table 1: results of the organochlorine pesticides in Iselegu wetland and WHO MPC in ug/l

Parameters	A	B	C	D	E	Mean	SD	WHO MPC
Adrin	0.60	0.50	0.60	0.70	0.60	0.60	0.07	0.30
Diedrin	0.20	0.31	0.21	0.10	0.11	0.12	0.09	0.005
Edrin	0.22	0.20	0.10	0.12	0.10	0.15	0.06	0.002
DDT	2.01	2.10	2.01	2.13	1.20	1.9	0.39	1.10
Heptachlor	0.21	0.32	0.23	0.33	0.31	0.28	0.06	0.10

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The results of the organochlorine pesticides in Iselegu wetland were further presented as in Figure 2.

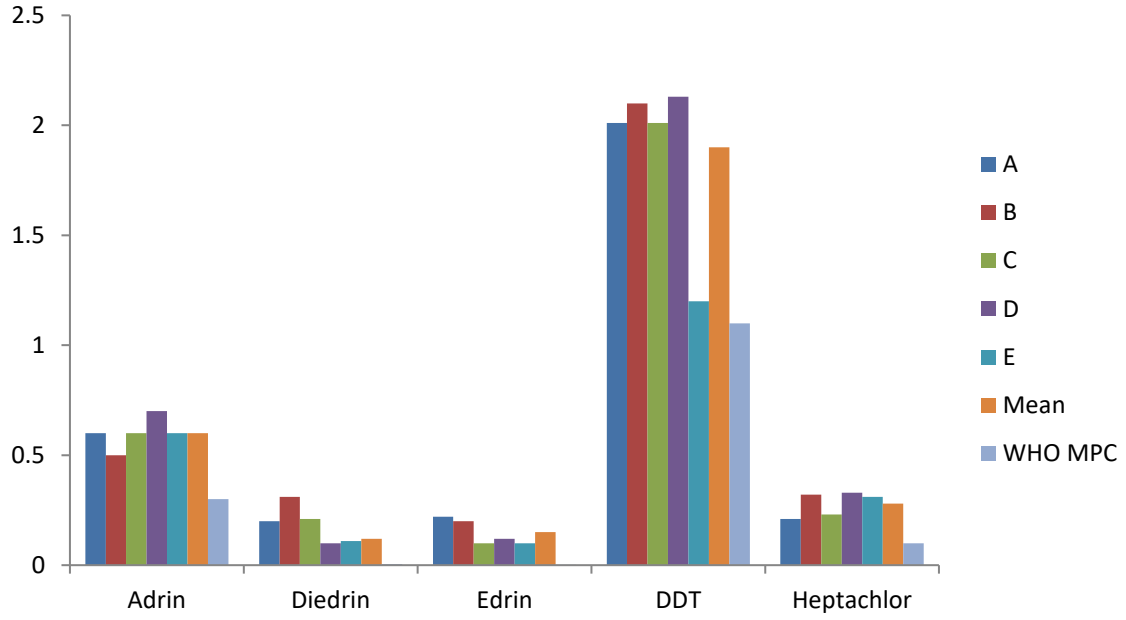

Figure 2: Organochlorine pesticides in in Iselegu wetland and WHO MPC in ug/l

The mean results of the organochlorine pesticides were further subjected to test of significance with statistical tool analysis of variance (ANOVA) deploying SPSS model 29 at 0.05 level of significance. The *p* value was 0.45, thus rejecting H_o.

4. DISCUSSION OF FINDINGS

The analysis of the water samples from the Iselegu wetlands presented varying contents of the organochlorine pesticides investigated.

The concentration of adrin varied from 0.50 µg/l to 0.70 µg/l with mean concentration of 0.60 µg/l. The WHO MPC for adrin in water is 0.50 µg/l. The increased adrin in the wetland is anthropogenic. Similar report of high content of adrin in wetlands is in Bamgboye, (2022) who reported high content of adrin in Ogun River and Ogwu et al., (2022) who also reported high adrin contamination in the wetlands of oil bearing communities of the Niger Delta.

The concentration of diedrin the analysis revealed was between 0.10 µg/l to 0.31 µg/l with a mean concentration of 0.12 µg/l. The World Health Organization maximum permissible concentration for diedrin in water is 0.005 µg/l. This high content of diedrin in Iselegu wetland is an after effect of pest control measures adopted by the farmers. This report is similar to the report of Osadolar and Igbinovia (2018) in Ovia River Benin City. Ogwu et al., (2022) also reported high content of edrin in wetlands of the oil bearing communities of the Niger Delta.

The wetland water analysis of Iselegu wetland revealed that the concentration of edrin was between 0.10 µg/l to 0.22 µg/l with a mean concentration of 0.15 µg/l. WHO MPC for edrin in water is 0.002 µg/l. This high content of edrin in the wetland is the results of agricultural imput utility in the community. Adewunmi and Adekoya (2018) gave similar report in Olomoge wetland, Badagry, Lagos. Ogwu et al., (2021) also gave a smilar report in the wetlands of Niger Delta.

The concentration of DDT in Iselegu wetland as the wetland analysis revealed was between 2.01 µg/l to 2.13 µg/l. The WHO MPC for DDT in water is 1.10 µg/l. High content of DDT in water was reported in Ogwu et al., (2020), Ogwu et al., (2022), Ogwu (2021) at the wetlands of Niger Delta farming communities.

The analysis of the water in Iselegu wetlands showed that the concentrations of heptachlor range from 0.21 µg/l to 0.33 µg/l with a mean of 0.28 µg/l. The acceptable maximum content of heptachlor in water by WHO is 0.10 µg/l. This elevated content of heptachlor in Iselegu wetland is as a result of the application of organochlorine pesticides to the crops and animals. High content of heptachlor in water was in the reports of Ogwu et al., (2023), Ogwu et al., (2023) in the wetlands of Niger Delta and IN Osakwe and Ijirigho, (2022) who investigated organochlorine pesticides in Igbide wetalnds Isoko Delta State Nigeria.

5. CONCLUSION AND RECOMMENDATIONS

Education is the vehicle for economic growth and development of any given country. It is therefore imperative that the education curucular of any country be remodeled consistently to be in tandem with global changes in science, technology and for youths empowerment and job creation. So many models have been adopted for remodeling education for self-reliant in Nigeria but aquaculture deploying cage culture remain highly rated. Good quality water is a major factor in aquaculture and that under pins this study. The analysis of the water in the Iselegu wetlands has revealed that the wetlands is contaminated with organochlorine pesticides investigated above acceptable limits thus making the deployment of cage aquaculture not to be feasible in the wetlands by schools and youths in Iselegu and environs.

Against the backdrop of the results of the analyses of the water samples from Iselegu wetlands, the study recommends as thus.

1. cage aquaculture should not be implemented in wetlands in Iselegu
2. the pollution sources should be identified and discontinued.
3. the farmers should be educated on safe pesticides usage.
4. the impacted wetlands should be remediated as soon as possible to allow for the deployment of cage aquaculture in Iselegu wetland by secondary schools as a vehicle for remodeling education in Nigeria.

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