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Organochlorine Pesticide Characterisation of Emede Wetland Isoko South Delta for Pen Aquaculture in Secondary Schools as an Emerging Trend in Vocational and Technical Education in the 21st Century Nigeria

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ABSTRACT: This study is an ex-post facto research that investigated the organochlorine pesticides content of Emede wetland for its suitability for pen aquaculture in secondary school. The study answered 3 research questions and tested a hypothesis. To achieve this, the research area Emede wetland was mapped out into research cells. From each of the research cells, water samples were collected from 10 sampling spots, bulked and a composite drawn and fixed with HNO_3 and stored in ice cooled boxes for laboratory analysis. The analytical standards adopted for the study were USEPA, APHA and ASTM and the analytical instrument deployed for determination of the organochlorine pesticides was EPA 8081 ECD. The mean results obtained are as follows: adrin 0.76±1.4µg/l, diedrin 1.26±0.30 µg/l, DDT 2.13±0.42 µg/l, endrin 0.62±0.55 µg/l and heptachlor 2.13±0.42 µg/l. The results obtained were subjected to test of significance with ANOVA at 0.05 level of significance deploying SPSS model 21. The p-value is 0.31 thus rejecting Ho. The study recommends that pen aquaculture should not be implemented in Emede wetland, the pollutions source should be identified and blocked and remediation should be carried out in the wetland to resuscitate the wetland to its hitherto healthy status.

KEYWORDS: Bioaccumulation, Biomagnification, Organochlorine Pesticide, Pen Aquaculture, Remediation, Vocation and Technical Education.

INTRODUCTION

Vocational and technical education has been highly rated globally as the panacea for youths' employment for wealth creation, food security and for the economic growth and development of any country. Vocational and technical education is the education designed to assist all categories of human beings to understand the principles of production processes (Agbulu, 2016, Ojogwu, 2017). Vocational and technical education according to Ikeoji (2011) is the education given in secondary and post-secondary schools to enable them fulfill their manpower needs of a given country for economic growth and sustainability. United Nations Educational Scientific and Cultural Organisation (UNESCO) (2017) defined vocational and technical education as the aspect of educational process involving in addition to general education, the study of technologies and related sciences and acquisition of practical skills, attitudes, understanding and knowledge relating to occupations in various sectors of the economic and social life. Federal Republic of Nigeria (FGN) (2014) conceptualize vocational and technical education as education given in institution providing both scientific knowledge and practical skills required for a specific trade, employment or profession as a craftsman, technician/technologist and scientist of a similar level in business field of engineering and applied science Umeh, (2002), Sofuluwe, (2012), Udofia, (2013) surmise vocational and technical education as any form of education which sufficiently prepares an individual to perform adequately and creditably in his choosen occupation. This position was reiterated by Maduka (2017) Odumewu, (2018) that vocational and technical education is the study of technology and related science and the acquisition of practical skills, attitudes and knowledge relating to occupations in various sectors of the economic and social life. For National Teachers Institute (2018) vocational and technical education is any type of education that involves the use of the right instrumental devices, methods and techniques for developing skills while Jones (2019), Ahmed (2020) view vocational and technical education as that form of education which begins with broad-based and facilitate horizontal and vertical articulation within the educational system and between a school and the individual for lifelong learning of developing the necessary mental to technical and entrepreneurial skills and attitude. It is the aspect of education which leads to the acquisition of practical and applied skills as well as scientific knowledge (Ike, 2018, Hassan, 2018, Tsav, 2020).

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Vocational and technical education is the education for youths empowerment, job and wealth creation, youths unemployment (Samuelson, 2019). The world is faced with global youths unemployment crisis as 0.57 percent of youths are out of work worldwide, with Djibouti recording the highest in youths unemployment with 81.06 percent while Qatar has the lowest youths that are without jobs with 0.63 percent. (International Labour Organisation (ILO), 2020, International Monetary Fund (IMF), 2021). In the United States 3.6 percent of the youths are without job (United State Labour Department, 2018). United Kingdom has 3.1 percent of its youths in the last quarter of 2021 facing unemployment; Europe youths unemployment stood at 6.2 percent in 2021 (ILO, 2022). Egypt in Africa has 10.45 percent of youths without employment while South Africa has 35.3 percent of the youths looking for job placement (Reuter, 2022). In Nigeria 33 percent of the youths are without a job, thus representing 60 million youths who are struggling to eke a living. Youths unrest, banditry, internet fraud, kidnappings and cattle rustling are traced to the youths unemployment (Baldwin, 2019).

Plausible solution to youths unemployment in Nigeria is to inculcate in the youths the spirit of dignity in labour through proper education in vocational and technical education (Ishaku 2018, Aliyu, 2015).

Okoye, (2015), Obiyan, (2017), Okezie (2020) enjoined the federal government to deemphasize paper qualification to encourage youths to take vocational and technical education for wealth creation and economic growth. Osazuwe (2015) opined that federal government placement of high premium on certificate has resulted in youths high subscription for grammar schools to the detriment of vocational and technical schools.

Nigeria youths are encouraged to take the advantages of the trade and entrepreneur curriculum in 34 skills areas in senior secondary schools including fisheries (aquaculture) for occupation in fishery on graduation for empowerment, wealth creation and poverty eradication (Haruna, 2018, Ogwu, 2020, Okpalaka, 2020). Occupation in Fishery will solve youth unemployment, create wealth and ensure food security in Nigeria (Ogwu, 2021, Odoba, 2021, Bazunu, 2022). Nigeria is the greatest importer of fish in Africa closely followed by Egypt, South Africa, Cote d'Ivoire, and Mauritius and the fish importation volumes in 2021 stood at 691.8 million USD, Egypt 567.2million, south Africa 282.6 million, Cote d'Ivoire, 211.1 million and Mauritius 180.7 million USD (Food and Agricultural Organisation (FAO), 2019, World Food Programme (WEP), 2020). Nigeria annual fish demand as at 2021 was 3.60 million metric tonnes while its production stands at 1.1 million metric tonnes. (National Bureau of Statistics, NBS, 2021) International Monetary Fund (IMF), 2021, FAO, 2021). Ruwani (2020), Ogunsanya, 2019), Osugo, (2020) lament that the importation of fish leads to loss of foreign exchange, depletion of foreign reserves and widening the gap of youths unemployment. Youths are advised to go into aquaculture for employment creation and to reduce pressure on Nigeria currency (Nanono, 2020, Oteriba, 2020). Youths should take to aquaculture adopting pen aquaculture method which is an emerging trend in aquaculture in schools due to its low capital demand (Ogwu and Okonji, 2021, Bamgboye, 2020, Ukpe, 2021).

Pen aquaculture is the art of raising fish in a pen built on the floor of an existing natural water (Afolabi, 2014, Surez, 2018). Ogundipe (2014), Bawo, 2015) caution that water analysis should be carried out in any water sources to be utilised for pen aquaculture for possible presence of water pollutants to avoid bioaccumulation and biomagnification. Bioaccumulation is the tendency of pollutants within the aquatic environment to get into the cells and tissues of aquatic organisms while biomagnification is the propensity for such pollutants to multiply in geometry in the tissues and organ of the organisms from one trophic level to the next. (Michael 2018, Ogunwole, 2015). Water pollutants include microplastics, furans, dioxins, polyaromatic hydrocarbons (PAHs), heavy metals, pesticides such as carbamates, organophosphates and organochlorines (Agency for Toxic Substances and Disease Registry, 2012, United States Environmental Protection Agency (USEPA), 2013). Organochlorine are compounds containing carbon and chlorine atoms that are used for the manufacturing of pesticides (ATSDR, 2012, Ogwu, 2022). The health complications arising from ingestion of organochlorine in humans include cancer endometriosis infertility in both man and female and so on (USEPA, 2012, Atshana and Atshana, 2013). A wetland is an environment that harbours water for three to six months in a year (Udo, 2012, Okpu, 2015). It is against this backdrop of the foregoing that this study became imperative. The purpose of this study therefore is to determine the organochlorine pesticides content of Emede wetlands, Isoko Delta state Nigeria for pen aquaculture in secondary schools as emerging trend in youths' aquaculture thus emerging trend in vocational and technical education in the 21st century Nigeria.

The organochlorines pesticides to be investigated include adrin, diedrin, dichlorodiphenyltrichloroethane (DDT), heptachlor and endrin.

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The study was guided by the following research questions;

1. What are the concentrations of adrin, diedrin, dichlorodiphenyltetrachloroethane (DDT), heptachlor and endrin in Emede wetland.
2. Are the concentrations of the organochlorine pesticides within the maximum allowable concentrations for organochlorines in water as prescribed by World Health Organisation 2014.
3. Can pen aquaculture be adopted Emede in wetland by schools and youth in Emede and environs.

The study was guided by a hypothesis as thus

H_o: There is no significant difference between the organochlorine pesticides concentrations in Emede wetland and WHO maximum allowable concentration of the pesticides in water

STUDY AREA

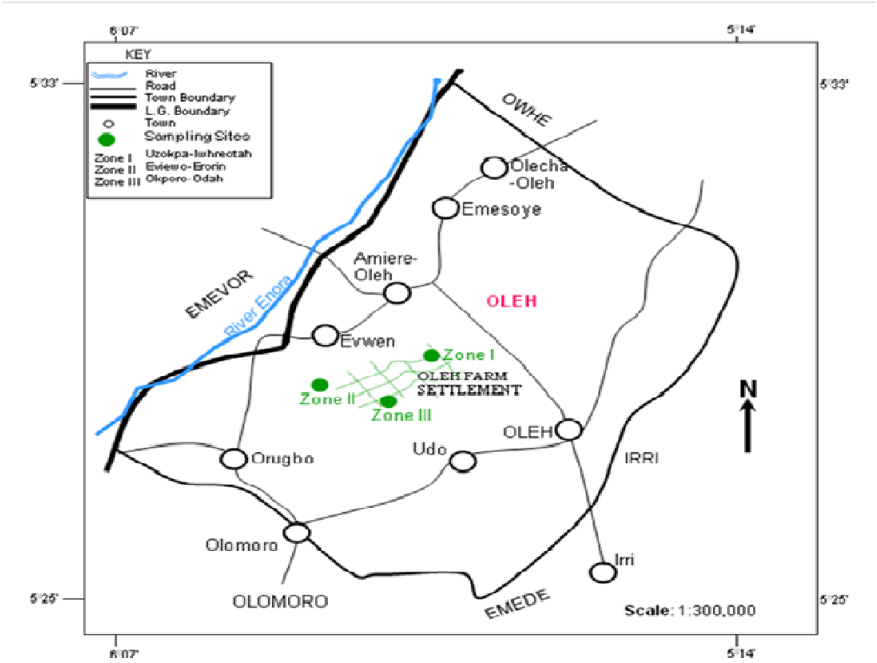

Figure 1: Map of Isoko South showing Emede
Source: Ojeh, and Victor-Orivoh, (2014).

Emede is in Isoko South local government area of Delta State, Nigeria. It lies within the geographical coordinates of 5° 24' 6N and 6° 40' 31" E. Emede has a population of 20, 160 people (National Population Commission, 2006) with 85 percent of the inhabitants being farmers (Okoro, 2018); the remaining being fishermen, petty traders, artisans and teachers. The major method of pest control adopted by farmers in Emede is chemical pest control and this is evident in the presence of backpack sprayers in almost every farmers home in Emede. Emede wetland lies on the southwest flank and it is the major recipient of waste from the agricultural inputs pesticides and fertilizers through runoffs, flash floods and erosion.

MATERIALS AND METHODS

Emede wetland was mapped out into research cells A, B. C, D. E (Adegboye, 2015, Odiko, 2018). From each of the research cells, water samples were collected from ten sampling spots, with a clean plastic sample bottle tied to a graduated string at the depth of 10cm and covered subsurface. The samples from each cell were bulked and composite drawn and fixed with nitric acid and stored in ice cool boxes for analysis in the laboratory.

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The analytical standards adopted for the samples analysis were United States Environmental Protection Agency (USEPA), America Public Health Association (APHA) and American Society for Testing and Material (ASTM). The analytical instrument deployed for the pesticide determination is EPA gas chromatography (GC) with electron capture detector (ECD) (EPA 8081 ECD).

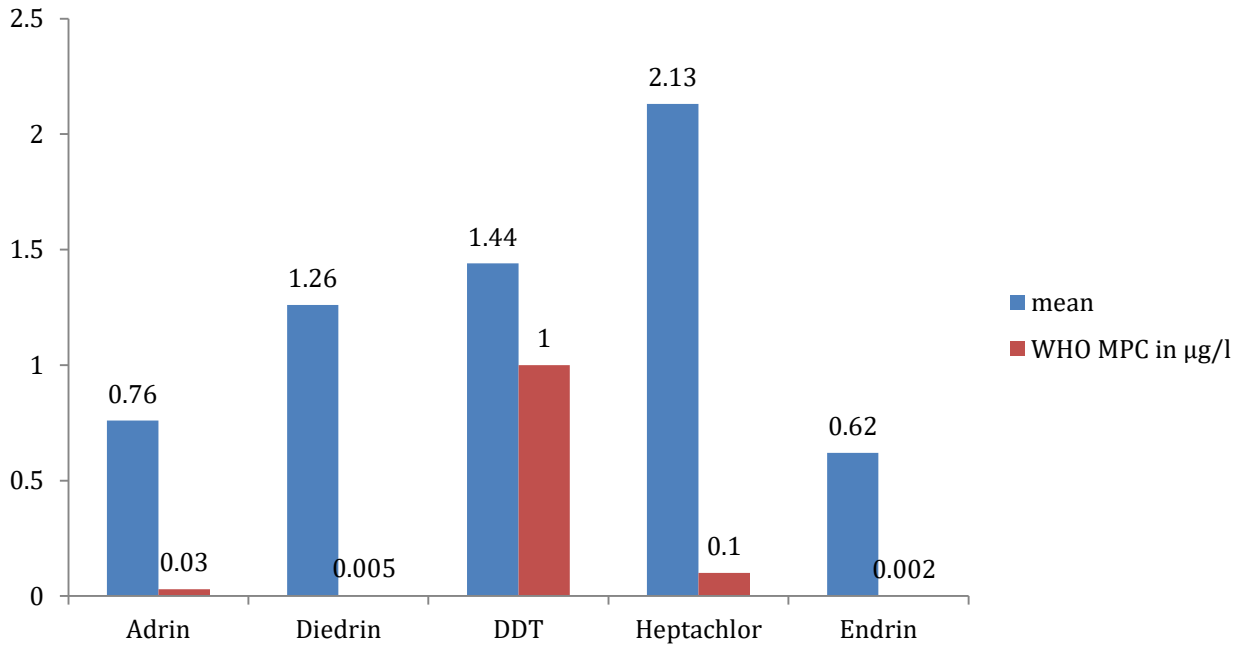
RESULT

The results of the analysis of the organochlorine pesticides content of Emede wetlands are as in Table 1.

Table 1: Organochlorine pesticides content of Emede wetlands and WHO maximum allowable concentration for organochlorine pesticides in water in ug/l

Parameters	Sampling cell (sites)					mean	Standard deviation	WHO MPC in µg/l
	A	B	C	D	E			
Adrin	.24	.97	.88	.76	93	0.76	0.10	0.03
Diedrin	1.32	1.41	1.09	1.03	1.44	1.26	0.19	0.005
DDT	1.92	1.02	1.48	1.36	1.41	1.44	0.32	1.00
Heptachlor	2.02	2.50	2.11	2.01	2.03	2.13	0.21	0.10
Endrin	0.99	0.67	0.43	0.51	0.48	0.62	0.23	0.002

Organochlorine pesticides in Emede wetlands were presented in graph as in Figure 2



The concentration of the organochlorine pesticides content of Emede wetlands in a decreasing order are as follows; heptachlor > DDT > diedrin > adrin > endrin

The organochlorine pesticides concentration in Emede wetlands were further subjected to test of significance with analysis of variance (ANOVA) with special package for social science (SPSS) model 21 at 0.05 level of significance. The p-value is 0.31 thus rejecting Ho. Thus revealing that the organochlorine pesticides investigated in Emede wetlands are higher in concentration than the acceptable concentration allowable for organochlorine pesticides in water by WHO, 2014.

DISCUSSION OF FINDINGS

The analysis of the organochlorine pesticides content of Emede wetlands revealed varying concentrations of the various organochlorine pesticides investigated. The mean concentration of adrin the investigation revealed is 0.76±0.10µg/l while the WHO

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maximum allowable concentration for adrin pesticides in water is 0.030µg/l. The concentration of adrin in Emede wetland is higher than the maximum allowable prescribed by WHO. High concentration of adrin in water has been reported by Ogwu et al., (2021) in Abam wetland Utagba-Uno, Delta State and Oduwole (2018) in Ogun River Ogun State.

The mean diedrin content of Emede wetland as shown by the investigation is 1.26±0.19µg/l while the WHO maximum allowable concentration for diedrin in water is 0.005µg/l. The content of diedrin in Emede wetland is higher than the acceptable limit by WHO. This report is similar to Okechukwu (2018) who reported high diedrin content in Omabara River in Anambra state but at variance with the reports of Amede (2017) who reported low content of diedrin in Igigo wetland in Utagba-Uno Delta Nigeria. DDT mean concentration in Emede wetlands as the analysis revealed is 1.44±0.32µg/l. The World Health Organisation maximum allowable concentration of DDT in water is 1.00µg/l. The concentration of DDT in Emede wetland is higher than the acceptable limit for DDT in water. High DDT content in water has been recorded by Okpala (2020) in Njaaba River in Imo state and Audu (2018) in River Agba in Kwara state. The Analysis of heptachlor in Emede wetland showed that the mean content of heptachlor in Emede wetland is 2.13±0.21µg/l. The WHO (2014) maximum allowable concentration for heptachlor in water is 0.10µg/l. The content of heptachlor in Emede wetland is higher than acceptable limit recommended by WHO. This result is similar to the report of Ioyem and Lember (2018) in River Katsina-Ala, Benue State and Okoro (2017) who recorded high content of heptachlor in Ase creek Benekeku, Delta State. The organochlorine pesticides content analysis of Emede wetland showed that the mean concentration of endrin is 0.62±0.23µg/l. The WHO maximum allowable content of endrin in water is 0.002µg/l. The concentration of endrin in Emede wetland is higher than the acceptable limit for endrin in water. This result of endrin in Emede wetland is in agreement with the reports of Clark and Abioye (2015) in Olomoge Lagoon Badagry Lagos and Omoregie (2016) who recorded high concentration of endrin in Ovia River Benin City, Edo state, Nigeria.

CONCLUSION

The economic status of a country is predicated on the skills pool and productive strength of the workforce. Unemployment has taken a centre stage in economic discourses and thus demands urgent solutions for an improved economy and for the wellbeing of the citizens. Several models have been recommended for amelioration of youths unemployment and youths aquaculture in vocational and technical education have been highly favoured as most viable recipe for tackling this crisis, especially aquaculture deploying pen aquaculture methods. Good quality water is a major factor in aquaculture and that underscores this study. The result of the analysis of the organochlorine pesticides content of Emede wetlands revealed that the wetland is highly polluted with organochlorine pesticides much more higher than the levels recommended by WHO for organochlorine pesticides in water. Against this backdrop, the adoption and deployment of pen aquaculture to Emede wetlands as emerging trend in vocational and technical youths aquaculture in the 21st century Nigeria may not be feasible because of the inherent health implications involved in raising fish in organochlorine pesticides contaminated water.

RECOMMENDATIONS

Consequent upon the result of the investigation of the organochlorine pesticides content of Emede wetlands, the study recommends as follows:

1. pen aquaculture should not be practiced in Emede wetland by the schools and youths of Emede and environ.
2. the source of the pollutants should be identified and stopped.
3. decontamination and remediation of the wetland should be commissioned to return the wetland to its hitherto healthy status for deployment of pen aquaculture as an emerging trends in 21st aquaculture in secondary schools in Nigeria.

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