

DETERMINATION OF ORGANOCHLORINE PESTICIDES CONTENT OF ETHIOPE RIVER, ABRKA, NIGERIA FOR SECONDARY SCHOOLS HAPPA AQUACULTURE

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Abstract

The Federal Government of Nigeria in effort at reducing unemployment among youths, curb social ills, create wealth and thus food security, introduced trade and entrepreneurship curricula in various skill areas including fishery. Good quality water is a pre-requisite for production of healthy fish for human consumption. This study therefore focused on the organochlorine pesticides content of Ethiope River for happa aquaculture in secondary schools. The research location Ethiope River was divided into research sampling stations and these were Mudi beach sampling station, River Motel sampling station, McCarthy beach, Oria and Erhuovie sampling stations. From each of the sampling stations, water samples were collected with clean sampling bottles with graduated strings at 10cm depth and covered sub-surface. The samples from 10 sampling sites in a sampling station were bulked and a composite drawn, fixed with HNO₃ and stored in ice-cooled box with which they were taken to laboratory for analysis. The analytical methods adopted were EPA Model 3570E, APHA 311D and 303 and CAEM 939C. The pesticides were determined with HPLC/UVFD. The mean results obtained were PIP DDT 3.232 ± 0.69 , Haptachlor 4.46 ± 1.50 , Edrin 9.36 ± 1.97 , Adrin 7.25 ± 0.84 and Lindane 1.79 ± 0.35 . The mean results of the organochlorine pesticides investigated were subjected to test of significance with ANOVA with numerator 4 and denominator 20. The calculated F-ratio was 6.35 while F-ratio critical value was 2.44. This revealed that the concentrations of the organochlorine pesticides determined were higher than WHO/FME maximum permissible concentration. The study recommends that happa aquaculture should not be embarked on in Ethiope River by secondary schools in Abraka.

Keywords: Organochlorine, Pesticide, Happa, Aquaculture

Introduction

Nigeria's economy prior to independence was predicated on agriculture activities (Owegbemi, 2004). There were groundnut pyramids in Northern Nigeria, rubber and palm produce in the South, cocoa in the West which brought about the development that took place in the defunct western Nigeria (Olodjo, 2010). Ozah (2009) posited that Nigeria was agrarian country with agriculture accounting for over 90% Gross Domestic Product and 80% export earnings. In the view of Osakwe (2010), Nigeria's economy at independence was based

on agriculture, the per capita income was high and exchange rate of Nigeria naira was higher than the American dollar and equal to British pounds. This was also in consonance with the statement by Ozokwo (2013) that Nigeria economy before independence was hinged on agriculture which was buoyant and stable.

According to Nwadior (2010), the oil boom of the 1970s led Nigeria to neglect her strong agricultural and light manufacturing bases in favour of an unhealthy dependence on oil for 97 percent of export earnings and 80 percent of

federal government revenue. Simply put by Ojodu (2012), Nigeria's economic woes could be traced to her incursion into petro-dollar with total abandonment of agriculture to the peasants who neither had the strength nor did the finances to expand their holdings, thus, agriculture become a trade for the poor. Odaigbo (2009) corroborated this stand, that Nigeria once agrarian economy jettisoned agriculture for petroleum economy that is controlled by the world powers who determine oil prices, the outcome is an unpredicted and gloom future characterized by glut resulting in economic hiccups. Oluku (2013) gave an emotional assessment of Nigeria economic situation; and found out that there was good standard of living for the citizen, the exchange rate stable, recession never experienced until the abandonment of agriculture sector for petroleum where she could neither extract nor accurately calibrate the extracted. The outcome of this change is that today, the once independent economy now depends heavily on America, France and Britain to take decision on what happens in the world oil market. Jinadu (2012) recounting the effect of oil on Nigeria economy stated that Nigeria incursion into oil exploration and exploitation, resulted in so much money in the economy with little or no effort, the outcome was that the younger generation found it difficult to till the soil because of little reward leading to rural urban migration. Ojoko (2013) stated that weak economy being experienced today in Nigeria was occasioned by Nigeria wrong decision of embracing petroleum and pushing agriculture to second position. There was exodus of younger active generation to the cities in search of nonexistent wealth raked in by petroleum into the economy. According to Abanum (2014), the rural urban migration of youths in the 80s, and 90s resulted in depleting the farms of active young men and dislocating the city structures, and with the world economic recession and unemployment. Ubido (2012)

recounted that the world economic recession resulted in many factories ceasing to exist, giving rise to mass unemployment of both youths and adults.

According to Nigeria Federal Office of Statistics (2016), 24.9 percent or 50 million Nigerian youths are unemployed. Audu (2016) opined that Nigeria can only go back to her economic glory through agriculture. This was in agreement with the views of Adesina (2014), Okeleke (2013), Fashola (2013), Hakeem (2013) who suggested that the youth's unemployment in Nigeria could be solved by teaching them basic vocational skills in agriculture, carpentry, tailoring, metal works, pottery. Abubakar (2012) also stressed on the importance of inculcation of vocational skills in agriculture and other skill areas as model for solving youth unemployment problem.

The Federal government of Nigeria, in effort in reducing youth unemployment in Nigeria through skills acquisition, introduced new senior secondary trade and entrepreneurship curricular (SSSTC) in 2013 in 34 skill areas including fishery. The philosophy of the SSSTC according to Nigeria Education Research and Curriculum Development Council (NERDC) is that every senior secondary education graduate should have been well prepared for higher education as well as acquired relevant functional trade/entrepreneurship skills needed for poverty eradication, job creation and wealth generation; and in the process strengthened further the foundations for ethical, moral and civic values acquired at the basic education level. The SSSTC is to inculcate in the students the ability and skills to put together all the factors of production to start and sustain a business.

The introduction of fishery in the new senior secondary school trade and entrepreneurship curricular is a laudable idea. According to

Ebuka (2013), fish is an essential source of protein for both adult and children. Low protein intake in the main cause of poor health and death in human especially in sub-Saharan Africa. Hassana (2000) stated that fish is an affordable source of animal protein for the rural and urban dwellers, compared to beef, mutton or Chevron, it is thus a possible means of achieving human daily protein intake requirement of 60g per day per person as recommended by the World Health Organisation. Odum (2005) lamented that fish was known to be the cheapest source of good quality protein for a healthy populace, however, in Nigeria, the trend in the past years has shown that fish is fast getting out of reach of people and the daily requirement of 60g per day as recommended by WHO is becoming attainable.

According to Dada (2005), the total fish demand in Nigeria is about 1.5 million metric tonnes while the current domestic fish production is 750MT. The implication is that the shortfall between demand and supply is bridged through importation. United States Agency for International Development (USAID) (2010) reported that with the importation of 750MT of fish by Nigeria more than 600 million USD is lost in foreign exchange and thousands of employment exported in the process. Ajali (2012) corroborated this stand that Nigeria spends over 100 billion naira annually in fish importation to bridge the gap between demand and supply, in the process she loses foreign exchange and create unemployment. Musa (2012) suggested that youth unemployment could be curbed through engaging them in aquaculture enterprise. Atanda (2005) equally recommended that youths could be empowered by inculcating aquaculture skills rather than endless search for white collar jobs. Babafemi (2014) counseled that youths could go into aquaculture using less capital intensive method such as cage, pen or happa culture. Good

quality water is an inevitable factor in each of the methods. For effective aquacultural practices, therefore, there is need for water analysis. Teddy and Teddy (2005) advised that water analysis should be carried out for possible presence of pesticides and other Persistent Organic Pollutants (POPs) such as polychlorinated biphenyls (PCBs) heavy metal, total petroleum tar in water.

The presence of organochlorine pesticide in water sources have been reported by Adeyemi, Anyakara, Ukpo & Adebayo (2010), Alani, Drouillard, Kehinde and Babajide (2012); Walker (2009); Wells (1993); Nwakwoala and Osibanjo (1992). According to Sigsha (2010), the presence of pesticide residue in water environment results in bioaccumulation and biomagnification. Bioaccumulation according to BioFactsheet (1998) is the high concentration of substance in biological tissues, of organisms at trophic level, while biomagnification is the increasing concentration of a substance in a food chain from one trophic level to the next. Miller (2006) defined bioaccumulation as the absorption and storage of molecules in certain organs and tissues of the body while biomagnification is the increase in concentration of such molecule or toxins as they pass through various trophic levels. Okecha (2000) reported that consumption of fish from pesticides contaminated ponds resulted in death of hundreds of people in Ilaje area of Ondo, Nigeria. The assessment of the pesticides loading of Ethiopia River, for secondary school success in happa aquaculture is thus germane for production of fish safe for consumption and youths' empowerment and national development. Happa net according to Jones (2013) is a cage-like rectangular or square net impoundment placed in natural water for the purpose of culturing fish while Uzundu (2014) described happa pond as a simple net used in raising fish in natural water body.

Purpose of the Study

The purpose of the study was to determine the concentrations of organochlorine pesticides in Ethiope River for secondary schools happa aquaculture in Abraka

Research Questions

To achieve the purpose of the study, the following research questions were posed.

1. What are the contents of organochlorine pesticides, viz PIPI DDT, Haptachlor, Eldrin, Aldrin and Lindane (γ HCH) in river Ethiope?
2. Were the organochlorine pesticides concentrations within the WHO and Federal Ministry of Environment (FME) Maximum Permissible Concentrations (MPC)/levels?
3. Can secondary schools in Abraka embark on happa aquaculture in river Ethiope?

Hypothesis

There is no significant difference between the organochlorine pesticides concentration in Ethiope River and recommended level by WHO/FME MPC.

Materials and Methods

The study adopted an ex-post facto research design and was carried out in Ethiope River. The river was divided into research stations which were River Motel research station, McCarthy Beach station, Erhuovie and Oria research stations. From each of the research stations, water samples were collected from 10 spots with clean sampling bottles at 10cm depth and covered subsurface. The samples from each of the sampling points were bulked, composite drawn, fixed with HNO₃ and stored in ice cooled boxes with which they were transported to the laboratory for analysis.

Analysis of Samples

The analytical method adopted for the study were EPA (American Environmental Protection Agency) model 3570e, American Public Health Association (APHA) model 311D (3rd edition) and 303 (5th edition) and Chemical Analysis of Ecological Matter (CAEM) method 939C (2nd edition). The pesticides were determined with HPLC/UVFD (High performance liquid chromatography coupled with Ultraviolet Florescent Detector).

Results

Table I: The result of the organochlorine pesticides content of Ethiope River

Organochlorine	A	B	C	D	E
P-P-DDT	3.58	2.56	4.21	2.59	3.22
Haptachlor	4.67	2.89	6.86	3.55	4.34
Edrin	9.34	8.56	12.76	7.86	8.32
Aldrin	6.56	7.32	8.56	6.45	7.36
Lindane (γ – HCH)	1.32	2.01	2.01	1.52	2.11

Key: River Ethiope at

- A Mudi Beach
- B River Motel Beach
- C McCarthy Beach
- D Erhuovie
- E Oria

The results were subjected to statistical treatment with mean, standard deviation and variance as presented in Table 2.

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Table 2: The result of the statistical analyses organochlorine pesticides in Ethiopie River

Parameter	N	Mean	Std Deviation	Variance
P ^I P ^I DDT	5	3.232	0.696	0.485
Heptachlor	5	4.462	1.509	2.278
Edrine	5	9.364	1.974	8.898
Aldrin	5	7.250	0.843	0.712
Lindane (γ – HCH)	5	1.794	0.351	0.123

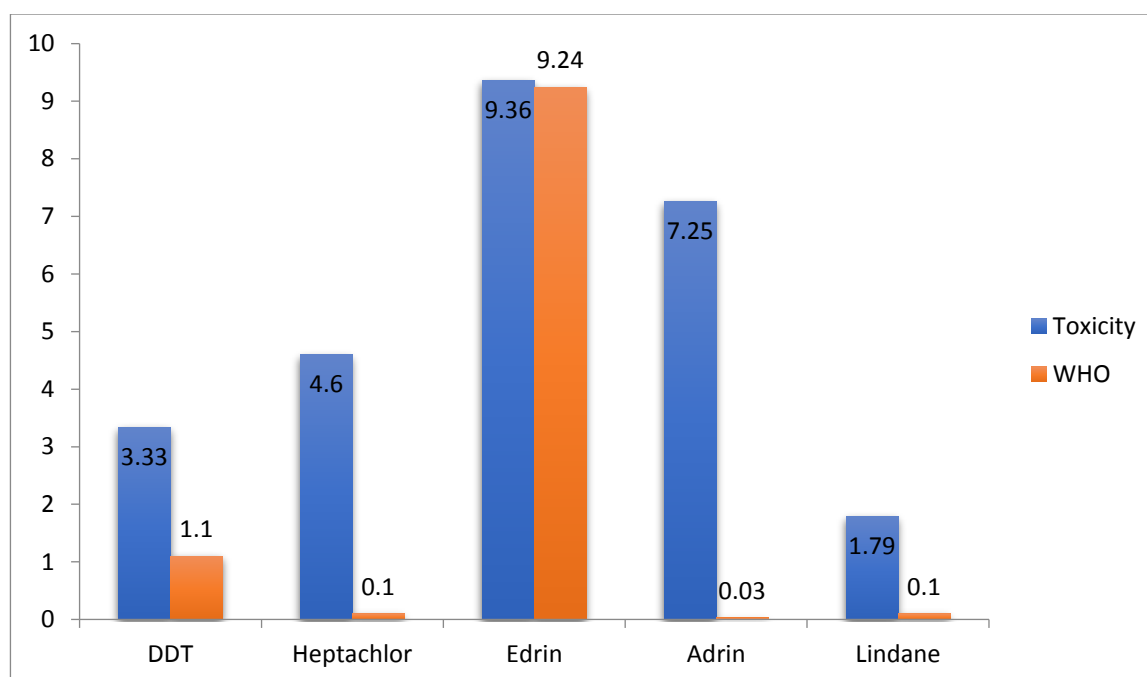


Fig. 1: Bar Chart showing the concentration of Organochlorine pesticides determined in microgramme per litre ($\mu\text{g/L}$)

The result of the analyses revealed the mean concentration of the organochlorine pesticide measured in the order of decreasing concentration as follows: Edrin 9.36 > Aldrin 7.25 > Haptachlor 4.66 > DDT 3.33 > Lindane 1.79. The results were further presented graphically with a bar chart as shown above.

Discussion

The prime motive of the policy framework of the senior secondary school trade entrepreneurship curriculum in fishery is to inculcate in the students the skills needed for a successful aquaculture enterprise. Good quality

water devoid of pollutants such as organochlorine pesticides, heavy metals polychlorinated biphenyls heavy metal and total petroleum in water is a major factor in fishery and thus underpin this study.

The result of the study revealed that mean concentration of Dichlorodiphenyltetrachloroethane (P^I P^I DDT) obtained in Ethiopie River was 3.23 $\mu\text{g/L}$ while the World Health Organisation Maximum Permissible Concentration for DDT is 1.1 $\mu\text{g/L}$, the mean concentration of Heptachlor was 4.46 $\mu\text{g/L}$ while the WHO MPC is 0.1 $\mu\text{g/L}$. The results also revealed the mean concentration of

Edrine of 9.36, and the WHO MPC for Edrin is 9.24 $\mu\text{g/L}$. Aldrin analyses showed a mean concentration of 7.25 $\mu\text{g/L}$ as against WHO MPC of 0.03 $\mu\text{g/L}$ and Lindane (γHCH) mean concentration in the area investigated revealed a mean concentration of 1.79 $\mu\text{g/L}$ as against WHO maximum permissible concentration of 0.1 $\mu\text{g/L}$. These means of the variables investigated were clearly above the World Health Organisation stipulated limit allowable. The results obtained were further subjected to test of significance with Analysis of variance (ANOVA) statistical instrument with degree of freedom numerator of 4 and denominator 20. The F-ratio calculated was 6.35 while the F-ratio critical value was 2.44, the decision is reject H_0 and accept H_A . That is there is significant difference in the concentrations of organochlorine pesticides determined in river Ethiopie Abraka and World Health Organisation maximum permissible concentration. This reveals that the concentrations are higher than maximum allowable concentration; therefore happa aquaculture should not be carried out in Ethiopie River Abraka.

The aim of developing curriculum in fishery in senior secondary schools according to NERDC (2013) is for the students to have fishery as a trade for livelihood on completion of their studies. Fishery is carried out through various culture methods such as earth pond, concrete, taupauline, cage, pen, happa, etc. The implication of the results of the organochlorine content of river Ethiopie is that the fish culturing cannot be directly carried out by students on the river and this portends a setback to the full implementation of SSTC in fish farming by the secondary schools in Abraka.

Result of this study is in consonance with the reports of Clarke (2011), Alani et al. (2011), Adeyemi et al. (2013) and Adegoke (2013) who recorded high concentration of organochlorine pesticides at Lagos lagoon, Olomoge Lagoon

and Bonny camp Lagos Nigeria. It is however not in agreement with Ojoye (2015) Osagie (2014) who reported low concentration of pesticides in Ogun River in Ogun and Lagos States and Ikpoba River Benin Edo State.

Conclusion and Recommendations

The scourge of *Ogwu Chukwudi* demands concerted efforts by major stakeholders – Federal and state government to bring it to the barest minimum. The only antidote to this seemingly intractable monster is inculcation of vocational skills such as fishery in youths. Production of healthy fish for the populace requires good quality water, free from pesticide contamination, to prevent bioaccumulation and biomagnification. The result of this study clearly showed that river Ethiopie Abraka is contaminated with organochlorine pesticide much higher than WHO/FMC maximum permissible concentration.

Secondary schools in Abraka, should not use the water for fishery projects as contained in the SSSTC due to the level of organochlorine toxicity which could lead to death of fish seeds or bioaccumulate making them unwholesome for human consumption.

The study therefore recommends that: Happa aquaculture, cage or pen aquaculture should not be carried out in Ethiopie River but could be adopted using alternative water sources after testing.

References

- Abanum, B.N. (2014 22 April). Youth Unemployment in Nigeria and the Place of Vocation Skills Acquisition. Vanguard News, pp. 25.
- Adegoke, A.S. (2013). Analysis of Organochlorine Pesticides Content of Lagos Lagoon at Bonny Camp. Chemosphere Journal of Science, 41(6), 28-34.

- Adesina, A. (2014). Nigeria Transformation Agenda: The Fish Subset. A Press Conference by Honourable Minister of Agriculture.
- Adeyemi, D., Anyakora, C., Ukpo, G. Adebayo, G. (2010). Recent Data on Organochlorines Concentration in Water and Fish Samples from Lagos Lagoon. A Conference Proceedings University of Lagos Annual Research Fair Multipurpose Hall, University of Lagos Akoka Nigeria.
- Ajali, B.B. (2012). The States Agriculture Schemes and Youth Employments in Nigeria.
<http://www.youthemploymentandagriculture.com>
- Alani, R., Drouillard, K., Kehinde, O. and Babajide, A. (2012). Bioaccumulation of Organochlorine Pesticide Residues in Fish and Invertebrates of Lagos Lagoon Nigeria. American Journal of Scientific and Industrial Research 13(4), 221-232.
- Atanda, A. (2012 November 16). Nigeria Economy: A Roadmap to Success. Vanguard News, p. 28.
- Audu, O. (2016). Nigeria Can Be Self-sufficient in Wheat and Rice: A Press Conference by Nigeria Honourable Minister of Agriculture.
- Babafemi, S.A. (2014). Curriculum Trends in Nigeria Education System. African Journal of Arts and Humanities, 7(5), 221-235.
- Babajide, M.O. (2012). Technical and Vocational Education in Nigerian Schools: Problems and Prospect. Nigeria Journal of Research in Education, 6(3), 41-53.
- Bio-Fact Sheet (1998). Bioaccumulation and Biomagnification. Birmingham: curriculum Press Unit.
- Clarke, P.C. (2011). The Organochlorine Pesticides Characterization in Olomoge Lagoon Lagos. Asian Journal of Marine Science 20(5), 13-22.
- Dada, J.A. (2005). Nigeria Artisanal Fishing in Epe Creek and Ogun River. African Journal of Marine Science 12(6), 131-145.
- Ebuka, T.N. (2013). Climate Change and Nigeria Fish Landings. African Journal of Aquaculture 12(5), 41-53.
- Fashola, B.R. (2013). Youths Agricultural Scheme in Lagos State: A Press Conference by Lagos State Government.
- Hakeem, B.D. (2013). Where Nigeria Strayed.
<http://www.nigeriastrayed.com>.
- Hassana, B.L. (2000). The Place of Fish in Nigeria Economy. Asian Journal of Marine Research 7(5), 121-136.
- Jinadu, B.Q. (2012). The X-ray of Nigeria Oil Economy: The Blessings, The Curses.
<http://www.xrayofnigeriaoileconomy.com>.
- Jones, A. A. (2013). Happa Culture in Tropical Region Prospects and Problems. Journal of Marine Biology and Aquatic Science, 44(5), 61-82.
- Kodjo, T.N. (2010). The Trajectory of Nigeria economy.
<http://www.nigeriaeconomytrajectory.com>.
- Miller, G.T. (2006). Environmental Science Work with the Earth Canada: Wadsworth Group, Thomas Learning Inc.
- Musa, F.N. (2012 February 19). Technical and Vocational Skills Acquisition: The Antidote for Youths Unemployment in Nigeria. Vanguard News, pp. 20.
- Nigeria Educational Research and Curriculum Development council (NERDC) (2013). The New Senior Secondary Education Curricula: Trade/Entrepreneurship. NERDC Sheda Abuja.

- Nigeria Federal Office of Statistics Abuja (2016). Nigeria Unemployment Statistics.
- Nwadiolor, J.J. (2010, July 4). The Problems with Monocultural Economy. Vanguard News, pp. 20.
- Nwankwoala, A.U., Osibanjo, O. (1992). Baseline Levels of Selected Organochlorine Pesticide Residues in Surface Water in Ibadan by Electron Capture Gas Chromatography. Total Environmental Journal, 119(5), 179-190.
- Odaigbo, N.K. (2009). Nigeria Petroleum Economy in Distress: The Way Out. <http://www.nigeriapetroleumeconomy.com>.
- Odum, A. (2005). Nigeria and Fish Farming. Journal of Science and Environment, 16(2), 22-29.
- Ojodu, K.T. (2012). Why Nigeria Oil Economy is in Distress. <http://www.nigeriaoileconomy.com>
- Ojoko, A.N. (2013). Nigeria Economy Gloom: the Way Out of the Wood. <http://www.nigeriaeconomygloom.com>.
- Ojoye, S. (2015). Organochlorine Pesticides Content of Crabs Caught in Badagry Creek. African Journal of Marine Science 10(5), 61-74.
- Okecha, S. A. (2000). Pollution and Conservation in Nigeria Environment. Owerri, T'Afrique International Association WA.
- Okeleke, E.N. (2013 August 12). Youth Unemployment in Nigeria. A Testimony of a Mismanaged Economy. The Nation News, pp. 28.
- Okowa, A.I. (2015). Youth Employment in Agriculture Enterprise (YEGEP): A Delta State Youth Agriculture Scheme.
- Olodjo, J. A. (2010 May 5). Nigeria Economy Past, Present and Future. Nigeria Tribune News.
- Oluku, F.C. (2013). The Trajectory of Oil Base Economy: The Nigeria Question. <http://www.oilbaseeconomy.com>
- Osakwe, E.A. (2010 December 5). Agriculture in Nigeria: The Abandoned Jewel. Guardian News, pp. 25-26.
- Owegbemi, P.N. (2004, May 30). Oil: A Curse or Blessing. Africa Today News, pp. 6-8.
- Ozah (2009). Nigeria Economy on the Threshold. <http://www.nigeriaeconomy.com>
- Ozokwo, B.N. (2013). The Fact About Oil Economy: The Nigeria Case. <http://www.nigeriaoilandeconomy.com>.
- Sigha, B.C. (2010). Bioaccumulation and Biomagnification of Toxic Compounds in the Surface Water of Amijar River India. India Journal of Water Resources, 7(2), 13-22.
- Teddy, A.O. and Teddy, P.C. (2005). Determination of the Organophosphate Pesticides Content of Brakdou River Singapore. Asia Journal of Aquatic Science 7(5), 321-331.
- Timbrell, J. (1999). Principles of Biochemical Toxicology. London: Taylor and Francis.
- Ubido, A.B. (2012). The Origin of Nigeria EconomicDownturn. <http://www.nigeriaeconomicdownturn.com>
- United States Agency for International Development (USAID) (2010). Facts on Nigeria Economy. A USAID Publication on Africa Economy.
- Uzondu, P. A. (2014). The Constraints of Raising Fish Seeds Using Happa Pond in South East Nigeria. Asian Journal of Agriculture, 38(7), 12-25.
- Wells, D.E. (1993). Current Development in the Analysis of Polychlorinated Biphenyls (PCBs) Including Planar and Other Toxic Metabolites in Environmental Matrices in Barcello (ed.) Environmental Analysis Techniques

Applications and Quality Assurance.
Elsevier Science Publication, 113-198.

