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EVALUATION OF POLYCYCLIC AROMATIC HYDROCARBONS AND HEAVY METALS IN MAGGOTS FROM IN BAYELSA STATE, NIGERIA

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ABSTRACT

This study was carried out to examine heavy metals and polycyclic aromatic hydrocarbon concentration in Maggots located in Bayelsa state, Nigeria. The samples were digested and heavy metal PAHs analysis was carried out using Atomic Absorbance Spectrophotometer and Gas Chromatography respectively. From the results benzo[b]fluoranthene, benzo[k]fluoranthene, and benzo[a] pyrene as the highest concentration in the dried maggot samples with values 2.41ppm, 1.58ppm and 3.1 ppm respectively. The result for concentration of PAHs in fresh maggot indicates that the only PAHs available are Benzo[b] fluoranthene and Benzo[k]fluoranthene with values 0.04 and 0.01 ppm. The result for heavy metal in the two maggot samples indicates that the concentration in ascending orders is iron>zinc>manganese>copper with the other heavy metals been undetected in the samples.

KEYWORDS: Benzo[b] fluoranthene and Benzo[k]fluoranthene.

INTRODUCTION

The phrase chemical contamination is a clear indication of the presence of chemicals where they should not be or are present in an amount that is in a higher concentration than the amount that is attributed as safe. The chemical hazards are one of the main causes of food contamination that associated with foodborne disease outbreaks (Faille et al., in press). The origins of chemical contaminants are various from the field to the plate, namely soil, environment, disinfection by-products, personal care products, air, water, and packaging material. Some of these contaminants are in form of metals called heavy metals, others could be in form of chained benzene ring compounds called polycyclic aromatic hydrocarbons (PAHs).

The term heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. Heavy metals are natural components of the Earth's crust. They cannot be degraded or destroyed. To a small extent they enter our bodies via food, drinking water and air. As trace elements, some heavy metals (e.g. copper, selenium, zinc) are essential to maintain the metabolism of the human body. Heavy metals are dangerous because they tend to bioaccumulate. Bioaccumulation means an increase in the concentration of a chemical in a biological organism over time, compared to the chemical's concentration in the environment. Compounds accumulate in living things any time they are taken up and stored faster than they are broken down (metabolized) or excreted.

Polycyclic aromatic hydrocarbons (PAHs) are organic compounds that are formed from multiple fused aromatic rings, and each ring contains six carbon atoms. The structure of PAHs consists of two or more benzene rings fused together in different arrangements. The simplest PAH, naphthalene, contains two fused benzene rings, while more complex PAHs can have three or more rings. Some well-known PAHs include anthracene, phenanthrene, pyrene, and benzo[a]pyrene. *Zelinkova (2015).* They occur in natural and man-made environments, and can be found in substances such as coal, tar, and oil. PAHs are classified as tenacious organic pollutants they are not degradable or break down easily, and can remain in the environment for long periods of time. PAHs are released into the environment through different human activities, such as combustion of fossil fuels, industrial processes, and waste incineration. They can also be found in cigarette smoke and grilled or charred food. Exposure to PAHs can have a variety of harmful effects on both human health and the environment. PAHs are carcinogenic and can cause lung, skin, and bladder cancer. They are also linked to respiratory problems, skin irritation, and other health issues. PAHs in soil and water, and can be taken up by plants and animals, resulting in bio-accumulation and bio-magnification.

The manner in which a food is prepared or the process of food preparation could also be a great source of these contaminants to get access into food. In the case such as roasting which is very common in the niger delta region, contaminants from the fire source which is usually firewood can contain heavy metal and PAHs which can easily bioaccumulate into the food. This study has its focus on the concentration of heavy metals and PAHs in Maggot in Bayelsa state.

MATERIALS AND METHOD

Sample Collecion

Sample Area

Niger Delta University, Amassoma, Bayelsa State was selected for sampling.

Sample collection

The sample for this study is Bayelsa suya, the samples were gotten from Niger Delta University, Amassoma Bayelsa State.

PAHs Sample Analysis

Gas Chromatography was used to determine the concentration of polycyclic aromatic hydrocarbon in the samples.

Gas Chromatography Analysis

Gas chromatography are used for the separation and detection of non-polar compounds that are volatile and thermally stable. It is also used for the analysis of certain 404 Recent insights in petroleum science and engineering semi-volatile compound including PAHs 4qq.

Chromatographic condition

GC	Hp 6890 powered with HP Chemstation Rev. A09.1
Column:	HP-1
Column length	30m
Column ID	0.25m
Injection Temperature	250C
Detector Temperature	20C
Detector	FID
Initial Temperature	60c for 5mins
First Rate	15c/mins for 14mins and maintain for 3min
Second Rate	10c/mins for 5mins and maintain for 4mins
Mobile Phase or Carrier	Nitrogen
Nitrogen Column Pressure	30psi
Hydrogen Pressure	28psi
Compressed Air Pressure	32psi

Procedure

The dried and pulverized sample were made to be free of water by ensuring constant weight for a period of time in the laboratory. 0.5g samples A (dry maggot) sample B (fresh maggot) respectively were weighed into the 250ml conical flask capacity. The samples were defended by extracting the polycyclic aromatic hydrocarbons content of the sample with 30ml of the petroleum spirit three times with Soxhlet extractor that was equipped with thimble. The sample was hydrolyzed three times for complete hydrolysis to be achieved for the inutility of amino acids recovery. The Pulverized and defamed sample was soaked with 30ml of the IM potassium hydroxide solution and were incubated for 48 hours at 110°C in hermetically closed borosilicate glass container. After the alkaline Ureterolysis, the hydrolysate were neutralized to get pH in the range of 2.5-5.0. The solution was purified by cation-exchange solid-phase extraction. The Polycyclic aromatic hydrocarbons in purified solution were derivatized with ethyl chloroformate by the established mechanism.

Heavy Metal Sample Analysis

Sample Incineration

5g of each of the maggot samples was taken and placed in a crucible labelled accordingly. The crucibles containing the samples were heated at hot plate at 150 degree until the smoke from the crucibles ceases. The crucibles were then moved to a muffle furnace to ash the samples at 550 degree for 12 hours to completely digest samples. After incineration samples were taken out of the muffle furnace.

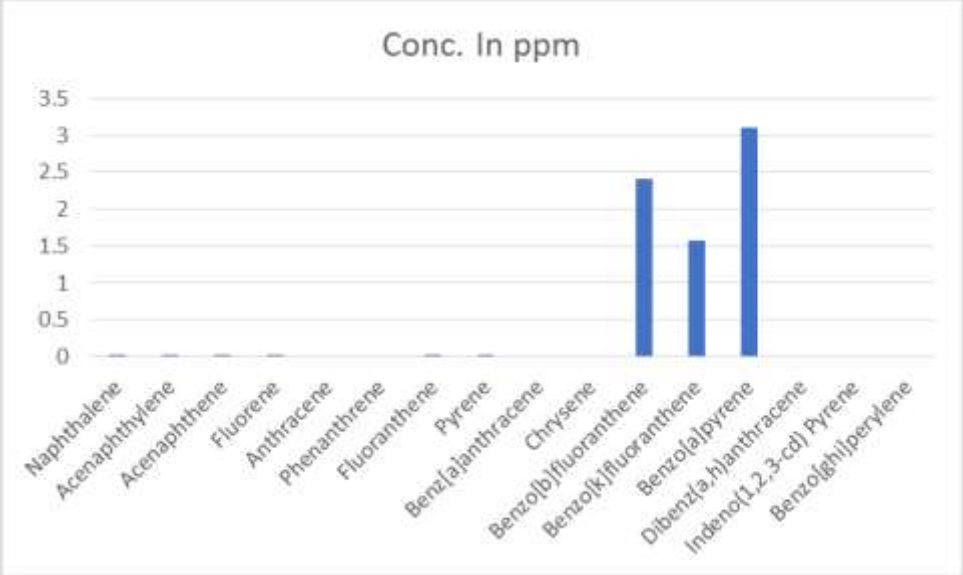
Sample dilution

Nitric acid was used to wash all the volumetric flask, glass rods and funnels used for sample dilution. About 30ml nitric acid was added to the crucibles containing the samples and mixed thoroughly with glass rod and was filtered into the volumetric flask using filter papers. Which was then taken to determine heavy metal concentration in AAS.

RESULTS

Table 1: showing the concentration of 16 PAHs in dried maggots.

Compound in ppm	Conc. In ppm
Naphthalene	0.01
Acenaphthylene	0.01
Acenaphthene	0.02
Fluorene	0.01
Anthracene	N.D
Phenanthrene	N.D
Fluoranthene	0.01
Pyrene	0.01
Benz[a]anthracene	N.D.
Chrysene	N.D.
Benzo[b]fluoranthene	2.41
Benzo[k]fluoranthene	1.58
Benzo[a]pyrene	3.1
Dibenz(a,h)anthracene	N.D.
Indeno(1,2,3-cd) Pyrene	N.D.
Benzo[ghi]perylene	N.D.

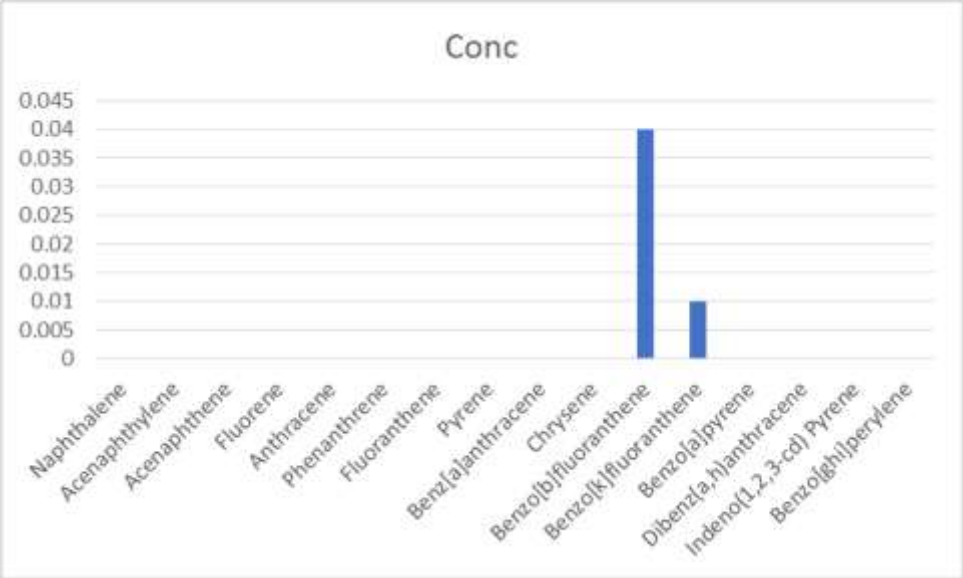


The table shows the results of a quantitative analysis of polycyclic aromatic hydrocarbons (PAHs) in Bayelsa dry suya, The results of the analysis show that the concentrations of PAHs in Bayelsa dry suya are high. The PAHs with the highest concentrations are benzo[b]fluoranthene, benzo[k]fluoranthene, and benzo[a]pyrene.

Table 2: Shows The Concentration of Pahs In Fresh Maggot.

Compound	Conc
Naphthalene	N.D
Acenaphthylene	N.D
Acenaphthene	N.D
Fluorene	N.D
Anthracene	N.D
Phenanthrene	N.D
Fluoranthene	N.D
Pyrene	N.D
Benz[a]anthracene	N.D
Chrysene	N.D
Benzo[b]fluoranthene	0.04

Benzo[k]fluoranthene	0.01
Benzo[a]pyrene	N.D
Dibenz(a,h)anthracene	N.D
Indeno(1,2,3-cd) Pyrene	N.D
Benzo[ghi]perylene	N.D



The table shows the results of a quantitative analysis of polycyclic aromatic hydrocarbons (PAHs) in Bayelsa fresh suya. The results of the analysis show that the concentrations of PAHs in Bayelsa Fresh Suya are very low. Only two PAHs, benzo[b]fluoranthene and benzo[k]fluoranthene, were detected in the sample. The concentrations of these two PAHs were 0.04 ppm and 0.01 ppm, respectively.

Table 3: shows the concentration of heavy metals in dried and fresh samples of maggots.

Metals	As	Hg	Cd	Mn	Cu	Zn	Pb	Ni	Fe	Cr
Dried Maggot	N.D	N.D	N.D	0.0035	0.0039	0.0064	N.D	N.D	0.0587	N.D
Fresh Maggot	N.D	N.D	N.D	0.0024	N.D	0.0008	N.D	N.D	0.016	N.D

The concentration of heavy metals were determined in 10 heavy metals. From the results the highest concentration was found in iron iron which had 0.0587 ppm as its concentration in dried maggot and 0.016ppm as its concentration in fresh maggot. For zinc, the highest value was found in dried maggot 0.0064 and lowest in fresh maggo 0.0024. manganese analysis showed that the highest concentration was found in dried maggot 0.0035ppm and fresh maggot had the value of 0.0024. copper concentration is 0.0039 ppm in dried maggot and it was not detected in fresh maggot. The concentration of heavy metals in the rest of the heavy metals were not detected.

DISCUSSION AND CONCLUSION

This study reports the metal and PAHs concentrations in dried fishes as dry weight basis. The concentration PAHs in dried fish was presented in table 1, The PAHs with the highest concentrations are benzo[b]fluoranthene, benzo[k]fluoranthene, and benzo[a]pyrene, the other PAHs were not detected in the sample. Table 2 PAHs, benzo[b]fluoranthene and benzo[k]fluoranthene, were detected in the sample. The concentrations of these two PAHs were 0.04 ppm and 0.01 ppm, respectively. However from the concentration and the amount of PAHs present in the both samples, it can be deduced that there is more concentration and amount of PAHs in dried maggot when compared to the fresh maggot. The presence of the traces of PAHs in the dried samples is as a result of the processing procedure, where by there is heat application applied to remove moisture content, the source of the heat by bring out PAHs due to the combustion, these PAHs will then in turn accumuate in these dried samples. The values of PAHs in these study are insignificant when compared to the findings of Silva, *et al*., (2011). Levels of PAHs in smoked fishes consumed by Nigeria.

Table 3 showed the concentration of 10 heavy metal in the maggot samples, from result obtained the concentration values gotten from dried maggots are above those gotten from fresh maggots, the reason of these is the processing procedure of the dried maggot samples. The sample with the highest concentration of iron heavy metal is found in dried fish 0.0587 ppm and fresh fresh maggot value is 0.016 ppm, zinc as its highest

value in dried maggot 0.0064 and its low value in fresh maggot 0.0008 ppm. The concentration of manganese in dried and fresh maggot is 0.0035ppm and 0.0024ppm respectively. The concentration of the other analyzed heavy metals were not detected.

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