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Level of Total Petroleum Hydrocarbon in Fish Samples Smoked with Different Combustible Materials

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Abstract
The determination of total petroleum hydrocarbon (TPH) in smoked fish samples were studied using six combustible materials, such as tyres, lubricating oil, polyvinyl chloride (PVC), plastics, iroko (*chlorophoraexcelsa*) wood and black velvet (*dialiumguineense*) wood. The result of the analysis indicates high TPH of mean value 0.8172g for fish sample smoked with tyre. The low TPH of mean value 0.0679g was obtained from fish sample smoked with iroko wood. This study established the formation of TPH during incomplete combustion of combustible materials used during smoking of fish samples. The associated health hazard of smoked fish were examined.
Keywords: Fish samples, Total petroleum hydrocarbon, Combustible materials, Toxicity.
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1.0 INTRODUCTION:

Fish is an important source of protein in our food. Fish is important in all countries all over the world. In some of the Asian countries people derive as much as 75% of their daily protein from fish. In West Africa especially Nigeria, fish accounts for 40% of animal protein intake. Fish is a food of excellent nutritional value, providing high quality protein and a wide variety of vitamins and minerals, including vitamin A and D, phosphorus, magnesium, selenium and iodine in marine fish. Its protein –like that of meat – is easily digestible and favourably complements dietary protein provided by cereals and legumes that are typically consumed in many developing countries. It has been shown that small quantity of fish shows significant positive impact in improving the quality of dietary protein by complementing the essential amino acids that are often present in low quantities in vegetable-based diets. Fish oils in fatty fish are the richest source of a type of fat that is vital to normal brain development in unborn babies and infants. Without adequate amounts of these fatty acids normal brain development does not take place (FAO 1995).

Smoked foods have been around for hundred of years and were originally used as a means of preserving meat and fish. In Nigeria various traditional methods are used to preserve and process fish for consumption and storage. The methods include smoking, drying, salting, frying and fermenting (Clucas 1982). Smoking of fishhave two main purposes namely:It gives the food a unique flavour that makes people to prefer it to non – smoked fish. The second use of smoking in that it makes the fish to last longer without decay. Smoking is an excellent way to preserve fish that you do not plan to eat immediately. In Nigeria most people especially those living in rural areas preserve their fish through smoking.

Total petroleum hydrocarbon (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products, which can contaminate the environment (Gustafsan 2007). Because there are so many different chemicals in crude oil and in other petroleum products, it is not practical to measure each one separately. However, it is useful to measure the total amount of TPH at a site (ATSDR 1999). The accidental discharge of hazardous materials such as petroleum and chemical solvents into aquatic environment have been a major public concern because of the adverse impact such chemicals have on human health and the environment (Ritschard*et al*. 1981; National Oceanic and Atmospheric Administration (NOAA) 1982; PTI Environmental Associates, 1989 and Bourodimos and Carvoumis 1990). TPH are absorbed and bioaccumulated by fish via food and water and from sediments, reaching higher levels in bile of the fish (Neff 1985; Moradi*et al*. 2012). Petroleum concentrations as low as 0.1ppm have been reported to be acutely toxic to marine larvae (USEPA 1986).

Atanda*et al.* (2011) evaluated the level of total petroleum hydrocarbon in fish samples smoked locally in different markets in Lagos, Nigeria and fish smoked with fabricated smoking kiln. The smoking were carried out using different types of wood and combustible materials. Serot*et al.* (2007) reported smoking of salmon fillets using four different smoking processes such as smouldering, thermostatic plates, friction and liquid smoke vapourization. Akpambang*et al.*(2009) investigated the polycyclic aromatic hydrocarbons (PAHs) of different smoked or grilled meat and fish products commonly consumed in Nigeria using a traditional method involving direct contact with wood combustion fumes. Igwe*et al.* (2012) investigated level of PAHs in smoked fish samples from Mushin area of Lagos, Nigeria. Polyaromatic hydrocarbons (PAHs) are formed during the burning of coal, oil, wood and other organics etc (Fetzer 2000) and PAHs are known to be toxic.

The aim of this study is to determine the level of TPH in smoked fish using various combustible materials. Total petroleum hydrocarbon is a precursor for the presence of polyaromatic hydrocarbons (PAHs) and their

associated health hazard were examined.

2.0 MATERIALS AND METHOD

2.1 Collection of Fish Samples

Fish samples catfish (Pure Dutch *Clarias*)were collected from a fish pond at Naze in Owerri, Imo State, Nigeria. The fish species were identified at Fishery and Aquaculture Department, Federal University of Technology, Owerri. Fish pond was chosen in this study to make sure that the fish was not contaminated from any other environment.

2.2 Preparation of Smoked Fish

1kg of fish samples were cleaned, weighed and stored in a refrigerator until use. The fish samples were place on a wire gauze and smoked for 6 hrs using smoking materials such as iroko (*chlorophoraexcelsa*) wood, black velvet (*dialiumguineense*) wood, plastics, polyvinyl chloride (PVC) pipes, lubricating oil and tyres, respectively. After smoking the fish samples were kept in an open tray for air drying. The fish samples were re-weighed after air drying to determine the moisture content. After moisture content determination the fish samples were ground and stored in a clean plastic container until use.

2.3 Extraction of Fish Samples.

10g of ground fish sample was added into an amber glass bottle. Anhydrous Na_2SO_4 was added into amber bottle containing fish sample and stirred using glass rod. 30ml of n-hexane was added into the bottle containing fish sample and the bottle was corked very tightly and transferred to a mechanical shaker (LAWI 2011). Then the mechanical shaker was agitated for 6 hrs.

After agitation, the sample was allowed to settle for 1 hr and then filtered through 110mm filter paper into an already weighed clean beaker. The extract was allowed to evaporate at room temperature in a fume cupboard. After evaporation the beaker was re-weighed. The difference in weight is the weightof total petroleum hydrocarbon(TPH) extracted from the fish sample.

3.0 RESULTS AND DISCUSSION

The result presented in fig 1. showeddifferent moisture content of combustible materials used for smoking of fish samples. The percentage of moisture content of combustible materials lubricating oil, tyres, plastics, PVC pipes, iroko wood and black velvet wood were 63.4%, 62.0%, 62.8%, 61.6%, 59.0%, and 60.0%, respectively. The lubricating oil has the highest moisture content of 63.4% of all the combustible materials studied, while iroko wood has the lowest moisture content of 59.0%. The order of moisture content were as follows:

Lubricating oil>Plastics>Tyres>PVC pipes> Black velvet wood>Iroko wood. The result of this study indicated that the wood smoking materials have less moisture content, when compared to other combustible materials.

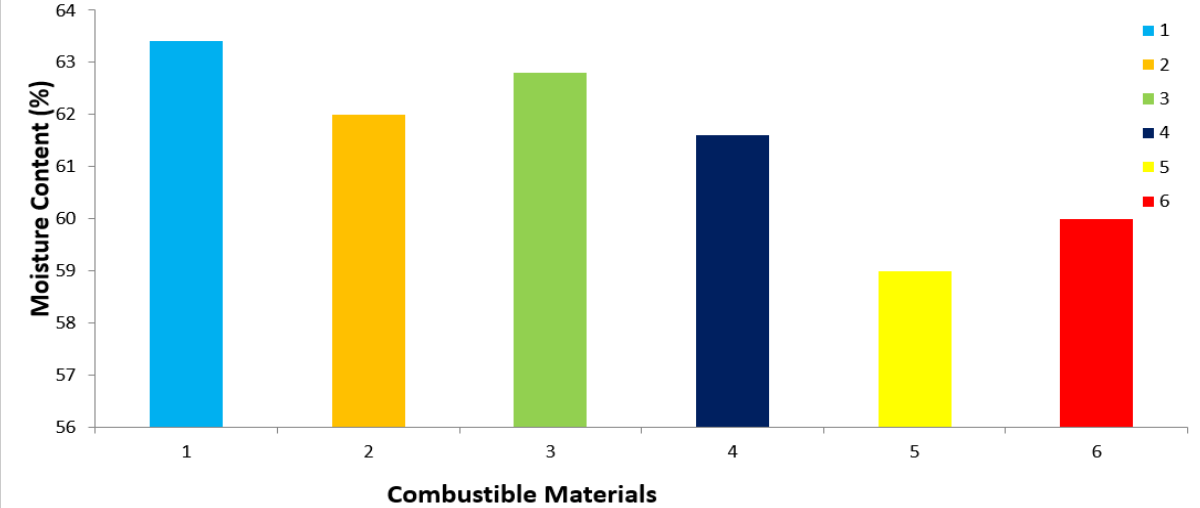

Fig.1 Moisture Content Of Different Combustible Materials

Legend:

1 = Lubricating oil
2 = Tyres
3 = Plastics
4 = PVC
5 = Iroko wood
6 = Black velvet wood

Fig.2 showed the level of TPH accumulation in fish samples using different combustible materials for smoking. The mean TPH accumulation in fish samples using different combustible materials such as lubricating oil, tyres, plastics, PVC pipes, iroko (*chlorophoraexcelsa*) wood and black velvet (*dialiumguineense*) wood were 0.5055g,0.8172g, 0.4769g, 0.6459g, 0.0679g and 0.0901g, respectively. This study indicated high accumulation of TPH in fish samples smoked with tyre as combustible materialwith mean TPH value 0.8172g. This study also indicated low mean TPH value of 0.0679g in fish sample smoked with iroko (*chlorophoraexcelsa*) wood as combustible material. The order of accumulation of TPH in fish samples using different combustible materials were as follows: Tyres> PVC pipes>Lubricating oil>Plastics> Black velvet wood>Iroko wood. This study generally indicated that all combustible materials studied accumulate high TPH in fish samples when compared to TPH accumulation in fish samples smoked with wood samples as shown in fig 2.

The high TPH value obtained from fish samples smoked with tyres might be attributed to the chemical composition of tyres. Tyres are polymeric with long chain. The breaking down of this long chain synthetic polymer by combustion, generate a lot of soot during smoking that might have penetrated into fish samples. The result of this study indicated low level of TPH in fish samples smoked with wood samples as show in fig.2. The low level of TPH

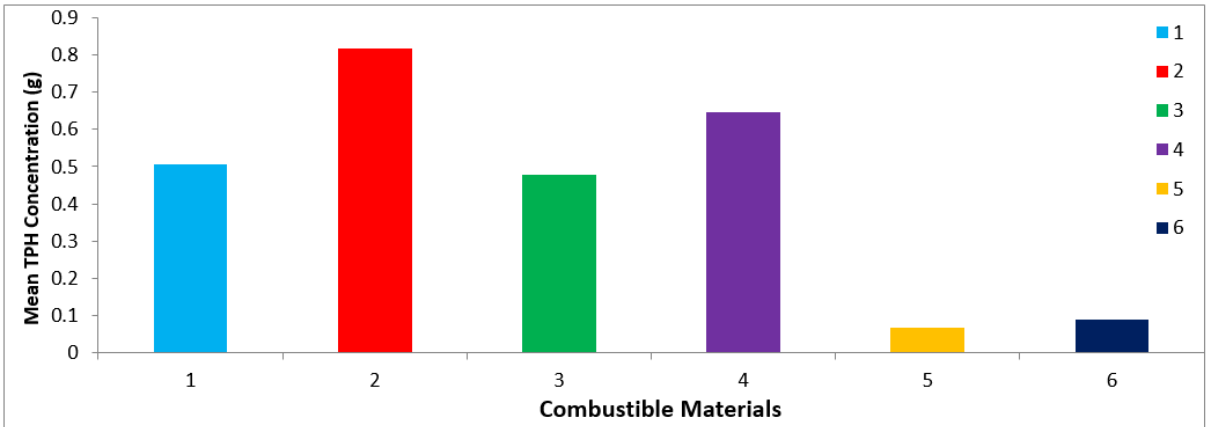

Fig.2 TPH Level of Fish Samples Smoked With Different Combustible Materials

Legend:
1 = Lubricating oil
2 = Tyres
3 = Plastics
4 = PVC
5 = Iroko wood
6 = Black velvet wood

in fish samples smoked with iroko (*chlorophoraexcelsa*) wood and black velvet (*dialiumguineense*) wood might be attributed to less complex composition of wood samples when compared to other combustible materials used in this study. Fish contaminated with TPH may be transferred to human being through food chain. It has been reported that TPH accumulation in the body causes leukemia,lymph cancer, blood cell cancer, tumors of breast (ATSDR 1999). Also one compound of TPH can cause headaches and dizziness at high concentrations and another compound can cause a nerve disorder called "peripheral neuropathy" this consist of numbness in the feet and legs. It has been reported that polyaromatic hydrocarbons (PAHs) were formed in large quantities as a result of secondary thermochemical reactions at high temperature over 700ºC (Ledesma *et al*. 2002). Reports have also shown that PAH compounds were formed during gasification and combustion (Mastral and Callean 2000; Richter and Howard 2000). It has been reported that polycyclic aromatic hydrocarbons were formed when incomplete combustion occurs (Lijinsky 1991). Reports have shown that PAHs were found in smoked foods, cooking oil fumes and tobacco smoke (Gomaa*et al*. 1993).

CONCLUSION

The result of this study indicated high level of TPH in fish samples smoked with tyres. The result of the analysis showed that all the combustible materials used in this study showed high level of TPH in fish samples except wood materials. Since the fish samples for this study were obtained from uncontaminated fish pond, it therefore showed that the TPH found in smoked fish samples were as a result of combustible materials used in smoking of fish. TPH compounds such as benzene, benzo (a) pyrene and gasoline are carcinogenic to humans (ATSDR 1999). Therefore unsmoked fish consumption is advisable to smoked fish, since smoked fish is prone to TPH contamination.

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