

Awareness and Impact of Black Soot on Selected Food Vendors in Port Harcourt, Rivers State, Nigeria

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Abstract

This study examined the impact of black carbon on the residents of Port Harcourt Metropolis of Rivers State, Nigeria. The objectives were to evaluate the awareness of black soot by the residents of the study area, evaluate the awareness level of respondents on the effect of black soot on health, and assess the impact of black soot on the income of some selected food vendors. Survey research design was used for this study. Simple random sampling technique was used to select 150 respondents from 10 communities in Port-Harcourt metropolis. Data collected for this study was analysed using descriptive statistics, Chi-Square statistical and simple linear regression. The results show that a significant number (96.7%) of Port Harcourt residents are aware of the presence of black soot. The residents (32.0%) are equally aware of the health dangers of black soot. 85% of the residents are aware of illegal bunkering being the number one cause of black soot. 78% of barbecue food vendors reported decreased patronage due to black soot pollution and the regression results shows that black soot significantly and adversely affects barbecue food vendors in Port Harcourt. The study concluded that the black soot negatively affects the livelihood of barbecue food vendors in Port Harcourt metropolis, and recommended that the vendors should take steps to employ hygienic practises so as to mitigate the effect of black soot on their food they sell and also for the government to tackle illegal oil bunkering as it is the major cause of black soot in the state.

Keywords: *Black Soot, Carbon, Emission, Air Pollution, Environment.*

Introduction

Black soot is substance formed by combustion, or separated from fuel during combustion, rising in fine particles, and adhering to sides of the chimney or pipe conveying smoke especially the fine powder consisting chiefly of carbon that colors. Air Pollution is the introduction of particulate or gaseous contaminants into the atmosphere, in quantities that can cause adverse changes in the environment. It is characterized by an increase in the oxidizing capacity of the atmosphere, reduced atmospheric visibility, and the deterioration of air quality

in a region Wang et al, 2014. It significantly influences the climate, living environment, and human health. Ilten, and Akpinar, et, al (2007).

The environment has been at the receiving end and overburdened with aftermath of the excesses of humans in their struggle for survival. Our Environment is a complex weave of physical, chemical and biotic factors that interact with each other and impact upon all living things and their surroundings. It is a life supporting system for human existence and survival as well as provides required for socio-economic progress (UNEP, 2011). The environment is the source of global economy that must be protected and managed sustainably, all efforts directed at managing and administering the environment is to ensure the continued existence of the biological diversity entities on the earth of which humans are the prime species and without it, which humans cannot exist (Aluko.O. 2005).

Air, a non-visible form of matter is one of the most important of earth's resources without which life cannot exist on the planet, which however as sad as it sounds is becoming more of a curse than a blessing in disguise. According to the World Health organization (WHO) air pollution occupies a position of largest percentage among all of the environmental risks: 3 million annual deaths or more are associated with outdoor air pollution exposure. In 2012 alone, 11.6 percent of global deaths equivalent to 6.5 million deaths were outdoor air pollution-related. 94% of the approximately 90% of air pollution-related deaths occurring in low- and middle-income countries are as a result of non-communicable diseases, including cardiovascular diseases (CVDs), chronic obstructive pulmonary disease (COPD), and lung cancer. Industrial activities constitute a principal source of air pollution Data for Nigeria's air quality status contained in the Little Green Data Book 2015 puts the population exposed to air pollution at PM2.5 levels, and exceeding WHO guidelines, at 94%. This number is above the 72% Sub-Saharan Africa average. The poor are further disproportionately affected (WHO2016 Online)

Air becomes polluted when it carries gaseous and particulate matter at levels at which they become objectionable; capable of causing discomfort or harm to man or his amenities. The quality of air in the Port Harcourt metropolis and surrounding towns, as well as other parts of the Niger Delta have been studied by various scholars, who rank the region's air quality amongst the top 10 most polluted regions in the world.

The problem of Air Pollution which is a salient factor cannot be ignored, as it affects the day-to-day activities and livelihood of those in the study area. The main change in atmospheric composition is primarily due to the combustion of fossil fuels. Soot is a powder-like form of amorphous carbon, produced during the incomplete combustion of organic matter. Soot particles sampled during the 2016 soot pollution episode were described as black (elemental carbon) to greyish black in different particle size ranges. Gas-phase soot contains polycyclic aromatic hydrocarbons (PAHs).

In our day-to-day life we are exposed to different kinds of pollutants, which compromise our state of health and wellbeing. The heavy emission of black soot containing Particulate Matter (PM2.5) is the current situation in the study area, since the fourth quarter of 2016 till date, large deposits of soot has plagued the city of Port Harcourt. This situation leaves the over 6 million residents of Port Harcourt at risk of adverse health consequences most especially children (due to their premature respiratory organs) and the elderly. Aside from the negative intricate health effect and carcinogenicity of the soot, this research seeks to ascertain the economic impacts of the black soot on the residents of Port Harcourt (The Study Area), Hence the issue of air pollution is an ideal discuss and also the economic impacts on the citizenry.

Objective of the Study

The broad objective of the study is to economically examine the impact of black carbon on the residents of Port Harcourt Metropolis of Rivers State, Nigeria.

Specifically, the study seeks to:

- (i) To evaluate the awareness of black soot by the residents of the study area.
- (ii) To evaluate the awareness level of respondents on the effect of black soot on health.
- (iii) To assess the impact of black soot on the income of some selected food vendors

Theoretical Literature

This study was guided by two theories which were

- (i) The Green Economic theory
- (ii) Eco-capitalism theory

The Green Economic theory

Green economics defined as any theory of economics by which an economy is considered to be component of the ecosystem in which it resides after Lynn R. Khale (2014). Green economics is a methodology of economics that supports the harmonious interaction between humans and nature and attempts to meet the needs of both simultaneously. Green economic theories encompass a wide range of ideas all dealing with the interconnected relationship between people and the environment. Green economists assert that the basis for all economic decisions should be in some way tied to the ecosystem, and that natural capital and ecological services have economic value. (investopedia.com 2019).

The International Chamber of Commerce (ICC) representing global business defines green economy as “an economy in which economic growth and environmental responsibility work together in a mutually reinforcing fashion while supporting progress on social development” Karl Burkart defines a green economy as based on six main sectors: Renewable energy, green buildings, transport, management, Waste, Land management.

Eco-capitalism theory

Put forward by two most notable eco-capitalists or free market environmentalists, Terry L Anderson (2001) and Jonathan H Adler. (2014), Eco-capitalism, also known as environmental capitalism or green capitalism, is the view that capital exists in nature as "natural capital" (ecosystems that have ecological yield) on which all wealth depends, and therefore, market-based government policy instruments (such as a carbon tax) should be used to resolve environmental problems. The ideology of eco-capitalism was adopted to satisfy two competing needs: The desire for generating profit by businesses in a capitalist society and the urgency for proper actions to address a struggling environment negatively impacted by human activity, under the doctrine of eco-capitalism, businesses commodity the act of addressing environmental issues (Griffiths and Lucas, 2016).

Empirical Literature

Ewubare, & Okadigwe, (2018), Studied examined the effect of environmental emission and dispersion of pollutants from black carbon on the income of rural farmers in Etche, an epicenter of high yielding varieties of farm produce Black carbon reduced crop profits as a unit rise in oil leak decreased harvest wage by 2.45 naira. Also, a percentage increase in emission of black carbon greatly depressed farm income by 3.69 percent. In order to halt the continual emission and dispersion of pollutants from black carbon it is therefore, recommended that Mediations programs and additionally arrangements, for example, interest in innovative work, top and exchange framework, carbon assess strategy, reception of clean

power design, and other administrative measures ought to be composed so as to moderate the impact of black carbon and perhaps decrease its odds of discharge to the barest least.

Akuro adoki (2012), did air quality survey of some locations in the Niger Delta area. A survey of air quality in Oyigbo and environs in the Niger delta area of Nigeria revealed that air quality in the area is affected to varying degrees by industrial, human and natural activities. Results indicate that SO_x values were below acceptable values for ambient conditions at most of the locations. The annual average SO_x levels ranged between 92.0µg/m³ and 430µg/m³ against the DPR limit of 150µg/m³. A similar trend was observed for NO_x emissions whose annual averages ranged between 81.0µg/m³ and 150µg/m³. Levels of these atmospheric contaminants were influenced by season. The average acidity values (5.63, 5.57, 5.41 and 5.41) of rainwater collected over the monitored period show rain acidity. The low Conductivity values however indicated non-contamination of the rain water. Nwachukwu and Ugwuanyi (2010). Undertook the Environmental Assessment of Vehicular Emission in Port-Harcourt City, Nigeria. The following air pollutants were measured namely; nitrogen oxides (NO_x), sulphur oxides (SO_x), carbon monoxide (CO) and unburnt hydrocarbons (C_xH_y), as well as climatic elements – ambient temperature and relative humidity. The air pollutant levels obtained were compared with local and international standards. CO complied with international standard, but exceeded local standard. There is need for effective air pollution monitoring and control; this will go a long way to reduce the health risk associated with air pollution in the city.

Methodology

Study Area

Port Harcourt, the study area is the capital of Rivers State Nigeria, with area coverage of about 12,000Ha (NDDC, 2003). The area is an important industrial and commercial Hub or center with a number of flourishing industries such as Notore, Indorama Eleme Petrochemicals Company Limited, Port Harcourt Refining Company Limited and Dufil foods. The presence of potential energy from oil and natural gas has made Port Harcourt to become one of Nigeria's most important industrial cities.

Research Design

Survey research design was used for this study. Survey design is the one in which a group of items were studied by collecting, analysing and interpreting data from a few people considered to be representative of the study population.

Population of the Study

The population of the study was made up of the inhabitants of Port Harcourt metropolis who were directly or indirectly affected by Black soot.

Sampling Procedure and Sample Size

Simple random sampling technique was used to select 150 respondents from 10 communities in Port-Harcourt metropolis in a way that captures the study area.

Data Collection Method and Sources

The data used for this research was Primary Data, which was collected using well-structured questionnaire coupled with focus group discussions and interviews/interactions. Questionnaires were issued for respondents who were experts in environmental studies, health sciences, economics and other residents in the study area.

Data Analysis Techniques

Data collected for this study was analysed using descriptive statistics, Chi-Square statistical analysis to determine the awareness of the residents and simple linear regression to determine the effect of black soot on livelihood of residents.

Results and Discussion

Table 1 Membership of Awareness Group

Table 1 showing the respondent's participation in any awareness group regarding black soot emission in Port Harcourt Metropolis.

Characteristics	Frequency (n=150)	Percentage (%)
Yes	5.00	3.30
No	145.00	96.70
Total	150.00	100.00

Source: *Field Survey 2021*

Table 1 shows the respondent's participation in any awareness group regarding black soot emission, 3.30% of the respondents reported being members of awareness groups/campaigns to sensitize the public on the incidence and dangers of black soot emission, while 96.70% reported not having any affiliations with awareness groups. Those who indicated membership are majorly medical doctors and health workers interviewed.

Table 2 frequency and Chi Square analysis on the respondent's awareness level of black soot in Port Harcourt, Rivers State

	Aware	Not Aware	total	Test of Statistics
Frequency	145	5	150.0	
Valid percent (%)	96.7	3.3	100.0	
Observed Frequency	145	5	150.0	
Expected Frequency	75.0	75.0		
Residual Frequency	70.0	-70.0		
Chi-Square				130.667 ^a
Df				1
Asymp. Sig.				.000

Source: *Authors Computation from SPSS Version 23, (2021)*

The frequency show's that 145 respondents representing 96.7% of the population are well aware of the presence of black soot in Rivers State, while 5 respondents representing 3.3% of the study population reported not being aware of black soot in Rivers State. The implication of this finding is that the black soot phenomenon is a subject matter that the residents of port Harcourt are fully aware of. A two by one chi square contingency analysis was performed; from the frequency analysis it is clear that the population that is aware of black soot is more than those not aware.

Table 3 frequency and Chi Square analysis on the respondent's awareness level of black soot causing death

	Aware	Not Aware	total	Test of Statistics
Frequency	48	102	150.0	
Valid percent (%)	32.0	68.0	100.0	
Observed Frequency	48	102	150.0	
Expected Frequency	75.0	75.0		
Residual	-27.0	27.0		
Chi-Square				19.440 ^a
Df				1
Asymp. Sig.				.000

Source: Authors Computation from SPSS Version 23, (2021)

Table 3 Show's that 48 respondents representing 32.0% of the population are aware that black soot causes death, while 102 respondents representing 68.0% of the study population reported not being aware black soot causes death. The implication of this finding is that the bulk of residents residing in Port Harcourt metropolis are not aware that black soot can eventually cause death if the people are exposed to high doses of black soot for a very long time.

Table 4 frequency and Chi Square analysis on the respondent's awareness level on Illegal Refinery Causing Black Soot

	Aware	Not Aware	total	Test of Statistics
Frequency	128	22	150.0	
Valid percent (%)	85.3	14.7	100.0	
Observed Frequency	128	22	150.0	
Expected Frequency	75.0	75.0		
Residual	53.0	-53.0		
Chi-Square				74.907 ^a
df				1
Asymp. Sig.				.000

Source: Authors Computation from SPSS Version 23, (2021)

Table 4 shows that 128 respondents representing 85.3% of the population are aware that illegal refinery causes black soot in Port Harcourt, while 22 respondents representing 14.7% of the study population reported not being aware illegal refining of crude causes black soot in Port Harcourt. This show the residents of Port Harcourt are aware illegal crude refining causes black soot and they believe it to be the major cause of black soot in Port Harcourt

Table 5 Effect of Emission on Livelihood of Food Vendors

Characteristics	Frequency (n=150)	Percentage (%)
Decrease in Patronage	78.00	52.00
None	73.00	48.00
Total	150.00	100.00

Source: Authors Computation from SPSS Version 23, (2021)

Table 5, showing the frequency distribution of the effect of black soot emission on the livelihood of selected food vendors. The food vendor selected were those selling barbecue fish and Plantain. From the descriptive analysis conducted of the data obtained from the respondents concerning the effect of black soot emission on the income of selected food vendors, the results revealed that 78.00 % reported experiencing a decrease in patronage due black soot emission while 73.00% reported not having the patronage of their products affected by black soot emission

Table 6 Regression Analysis on the effect of Black soot on the income of selected vendors

Variables	Coefficient's	Std. Error	Beta	t-statistics	Sig.	N
Constant	-7.649E-17	.054	.052	.000	1.000	150
Did Black soot affect patronage		.036	.057	.636	.001	150
R-squared	.503					
Adjusted R-squared	.560					
S.E of regression	.18047					
Sum of squared Resid.	4.833					
F-Statistics	.405					
F-Probability	.002					

Source: Authors Computation from SPSS Version 23, (2021)

From table 6, the ANOVA table shows the F-Probability (overall significance) is 0.02 which is less than 0.05; the p value of the independent variable (black soot) proxy by awareness level of black soot is 0.001, which is less than 0.05 indicating there is significant relationship between black soot and the income of the selected food vendors in the study area. The coefficient of determination (R^2) is 50.3, meaning that black soot determines up to 50% the patronage of barbecue food vendors. This is in agreement with Ewubare and Okadigwe (2018), whose findings revealed that black soot negatively affects the livelihood of farmers in Etche local government area.

Conclusion and Recommendation

The study concluded that the black soot negatively affects the livelihood of barbecue food vendors in Port Harcourt metropolis, and recommended that the vendors should take steps to employ hygienic practises so as to mitigate the effect of black soot on their food they sell and also for the government to tackle illegal oil bunkering as it is the major cause of black soot in the state.

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