International Journal of Multidisciplinary Studies
Centre for International Studies, Osmania University,
Hyderabad –500007, (A.P.), India.
Online ISSN: 3349-4132
Print ISSN: 3349-5939
Volume 10, Issue 11, November; 2023
Page No.91-96

NATURAL POLLUTION AND CERAMIC PRACTICES IN THE SOUTH-SOUTH REGION OF NIGERIA

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Abstract
This study delves into the intricate relationship between ceramic practices and environmental pollution, focusing on the South-South region of Nigeria. The research comprehensively analyzes the pollutants generated throughout the ceramic production process and explores the methodologies employed in Environmental Impact Assessment (EIA). Utilizing a correlative design and a sample of 200 management staff from 50 ceramic companies, the study establishes significant positive relationships between pollutants generated and ceramic practices, methodologies in EIA, and potential mitigation strategies.Findings indicate that as pollutants increase, the effectiveness of ceramic practices becomes challenging. Moreover, the study highlights the vital role of EIA methodologies, showcasing that their implementation positively correlates with the efficiency of the ceramic industry. Additionally, potential mitigation strategies, when employed, lead to an increase in the ceramic industry's effectiveness. The results underscore the urgent need for sustainable practices in ceramic production. The study concludes with a series of recommendations, including the adoption of eco-friendly raw materials and energy-efficient technologies, stringent enforcement of regulations, investment in research for cleaner production, and international collaboration. These suggestions aim to mitigate the environmental impact of ceramic practices in the South-South region, emphasizing the importance of responsible consumption and environmentally conscious industrial approaches.

Keywords: Ceramic Practices, Pollutants, Environmental Impact Assessment.

INTRODUCTION

Ceramics, the art and science of making objects from clay, has a complex relationship with environmental factors, including natural pollution. Ceramic practices refer to the techniques, processes, and artistic methods involved in creating ceramic objects. Ceramics is the art and science of making objects from clay, which is shaped and then fired at high temperatures to achieve hardness, durability, and permanence. Ceramic objects can range from functional items like pottery and dishes to decorative pieces, sculptures, and architectural elements.

Environmental pollution is the most significant problem throughout the world. As the world is witnessing the rapid urbanization and industrialization, the need for energy and waste discharges are in an increasing trend. The waste discharge in any form (liquid or gas) causes a severe health problem, greenhouse gas emissions, water pollution and acid rain. In order to cater to the needs of the growing population, various industries have been started and manufacturing different products. These industries procure raw materials, process them and produce the finished products Catalina Research (2007). While manufacturing the finished products, these industries also produce various by-products and the world is finding challenges to dispose of those wastes and it causes pollution to the environment. Pollutions are also produced by various industries such as cement industry, fertiliser industry, dye, iron and steel, pesticides, oil refineries, textiles, tanneries, thermal power plant and the ceramic industry Hanif et al. (2005). The ceramic products are widely used as building material. The clean and good appearances are the special characters of the ceramic product. Hence, the ceramic products are accounted for more than 50 per cent in the building material Catalina Research (2007). The ceramic tiles production across the globe reached 13,056 million in

2016, which was 5.7 per cent higher than the previous year. The world consumers' demand was 12,783 million m2 in 2016. Furthermore, it is having an average growth of 5 per cent. The world's largest producer, as well as consumer of the ceramic product, is China, which contributes 5.47 billion m2 equivalents to 42.8 per cent of the world ceramic tiles production. India and Brazil are the next largest producers of ceramic products Bastianoni et al. (1999). Hence, the need for the ceramic products is increasing every year and to cater the need the industries around the world are producing the ceramic products rapidly. The production of the ceramic tiles involves various processes from mining to end product. During these processes also include the transportation of goods and it generates different types of pollutions, which affect the entire ecosystem when the ecosystem is affected, it may deface the world Petersen and Solberg, (2004); Rivela et al. (2007); Asif et al. (2007). A number of studies have investigated the environmental impact due to the ceramic industry (Fonseca et al., 2016; Almeida et al., 2013; Jaakkola et al., 2011). These studies have analyzed the impact due to specific parameters like sintering, smoke andCO_2 emission. To study the impact of pollution due to the ceramic industry across the globe, various techniques are used such as Life Cycle Assessment (LCA) methodology (Tikul&Srichandr, 2010), (Tikul, 2014), (Tikul&Srichandr, 2010) and Best Available Technique (BAT) (IbáñezForés et al., 2016). However, these studies have not addressed the comprehensive impact of all pollutants, which is caused by the ceramic industry. In addition, the available literature on the Environmental Impact Assessment confining to the ceramic tiles production is limited. Hence, the current work attempts to build on the existing literature by investigating the various types of pollutants, an effect of the pollutants and the methodologies used to assess the environmental impact caused by the ceramic industry are reviewed carefully and presented.

The ceramic production process involves various stages, each of which can generate different types of pollutants. Some of the pollutants that can be generated throughout the entire ceramic production process. Mining operations can generate dust and particulate matter, which, when airborne, contribute to air pollution. Chemicals used in mining and extraction processes can contaminate nearby soil and water sources, leading to water pollution.Grinding and shaping clay can produce airborne clay dust, which poses respiratory hazards and contributes to indoor air pollution. Water used for shaping and cleaning processes can become contaminated with clay particles and chemicals, leading to water pollution.

In the ceramic industry, Environmental Impact Assessment (EIA) methodologies are crucial for evaluating the environmental effects of production processes. Several methods and tools are employed to assess the impact of ceramic industry activities on the environment.

Life Cycle Assessment (LCA) provides a holistic view of the environmental impact of ceramic products from raw material extraction to end-of-life disposal. It quantifies environmental impacts, allowing for comparison between different products or processes. LCA helps identify the stages of production with the highest environmental impact; enabling targeted improvements.Environmental impact matrices provide a simple way to categorize and visualize various environmental impacts.Environmental pollution is reaching worrying proportions worldwide. Urbanization and industrialization along with economic development have led to increase in energy consumption and waste discharges. The global environmental pollution, including greenhouse gas emissions and acid deposition, as well as water pollution and waste management is considered as international public health problems, which should be investigated from multiple perspectives including social, economic, legislation, and environmental engineering systems, as well as lifestyle habits helping health promotion and strengthening environmental systems to resist contamination (Hassan & Loux, 2011).

Environmental pollutants have various adverse health effects from early life some of the most important harmful effects are perinatal disorders, infant mortality, respiratory disorders, allergy, malignancies, cardiovascular disorders, increase in stress oxidative, endothelial dysfunction, mental disorders, and various other harmful effects (Kelishadi & Poursafa, 2010). Though, short-term effects of environmental pollutants are usually highlighted, wide range of hazards of air pollution from early life and their possible implication on chronic non-communicable diseases of adulthood should be underscored. Numerous studies have exposed that environmental particulate exposure has been linked to increased risk of morbidity and mortality from many diseases, organ disturbances, cancers, and other chronic diseases (Coogan, White, Jerrett et al, 2012).

STATEMENT OF THE PROBLEM

The rapid urbanization and industrialization worldwide have led to a substantial increase in the production of ceramic products. The ceramic industry, a significant contributor to the global economy, faces a critical issue concerning environmental pollution. As industries produce ceramic items to meet the demands of a growing population, they generate various types of pollutants. These pollutants, in the form of liquid and gas discharges, pose severe health risks, contribute to greenhouse gas emissions, and contaminate water sources, leading to issues such as

acid rain. While existing studies have examined specific parameters like sintering, smoke, and CO2 emissions in the ceramic industry, there is a lack of comprehensive research addressing all pollutants generated by this sector. Despite the widespread use and production of ceramic products, there is limited research on the Environmental Impact Assessment specifically focusing on ceramic tiles production. Existing methodologies, such as Life Cycle Assessment (LCA) and Best Available Technique (BAT), have been employed to study certain aspects of environmental impact, but a comprehensive analysis considering all pollutants and their effects is missing from the current literature. Therefore, this study aims to address these gaps by conducting a detailed investigation into the various types of pollutants generated by the ceramic industry, understanding their effects on the environment, and critically reviewing the methodologies employed for assessing the overall environmental impact caused by ceramic production. By doing so, this research seeks to provide a comprehensive understanding of the environmental challenges posed by the ceramic industry and offer insights into sustainable practices and pollution mitigation strategies.

OBJECTIVES OF THE STUDY

The aim of the study is natural pollution and ceramic practices in the South-South region of Nigeria. Specifically, the objectives of the study are to;

1. *Analyze the various types of pollutants generated throughout the entire ceramic production process in the South-South region of Nigeria.*
2. *Assess the methodologies employed in Environmental Impact Assessment within the ceramic industryin the South-South region of Nigeria.*
3. *Explore potential mitigation strategies and sustainable practices that can be implemented by the ceramic industryin the South-South region of Nigeria.*

Research Questions

The following research questions guided the study.

1. *What are the various types of pollutants generated throughout the entire ceramic practices in the South-South region of Nigeria?*
2. *What are the methodologies employed in Environmental Impact Assessment within the ceramic industryin the South-South region of Nigeria?*
3. *What are potential mitigation strategies that can be implemented by the ceramic industry in the South-South region of Nigeria?*

Hypotheses of the Study

1. *There is no significant relationship between pollutants generated and ceramic practicesin the South-South region of Nigeria.*
2. *There is no significant relationship betweenmethodologies employed in Environmental Impact Assessmentand ceramic practicesin the South-South region of Nigeria.*
3. *There is no significant relationship betweenpotential mitigation strategies and ceramic practicesin the South-South region of Nigeria.*

METHODOLOGY

A correlative design was adopted. The population of the study comprised the fifty ceramic companies in the South-South region in Nigeria. Simple random sampling technique was used in selecting the study sample of 200 management staff from fifty ceramic companies in the South-South region in Nigeria.

Results

Research Question 1

What are the various types of pollutants generated throughout the entire ceramic practices in the South-South region of Nigeria?

Table 1: Relationship between pollutants generated and ceramic practices in the South-South region of Nigeria

Variables	N	$\sum X$	$\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$	r-cal
Pollutants generated (X)	200	97.80	59.53	82.69	70.30	61.85	0.63
ceramic practices(Y)	200						

Source: Field data, 2023

The data presented in Table 1 shows that the correlation coefficient between pollutants generated and ceramic practicesis (r-cal) = 0.63. This value shows that there is a positive and strong relationship exists between

pollutants generated and ceramic practices. This implies that as pollutants generated increases, effectiveness in ceramic practicesbecome difficult.

Research Question 2: What are the methodologies employed in Environmental Impact Assessment within the ceramic industry in the South-South region of Nigeria?

Table 2: Relationship between methodologies employed in Environmental Impact Assessment**and**ceramic industry in the South-South region of Nigeria

Variables	**N**	$\sum X$	$\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$	**r-cal**
Methodologies Employed (X)	200	49.71	49.33	74.08	70.30	73.11	0.68
Ceramic Industry (Y)	200						

Source: Field data, 2023

The data presented in Table 2 shows that the correlation coefficient between methodologies employed in Environmental Impact Assessment andceramic industry in the South-South region of Nigeria is (r-cal) = 0.68. This value shows that a positive and strong relationship exist between methodologies employed in Environmental Impact Assessmentandceramic industry in the South-South region of Nigeria. This implies that as methodologies employed in Environmental Impact Assessmentincreases, effectiveness in ceramic industry in the South-South region of Nigeria increases.

Research Question 3: What are potential mitigation strategies that can be implemented by the ceramic industry in the South-South region of Nigeria?

Table 3: Relationship between potential mitigation strategies and ceramic industry in the South-South region of Nigeria

Variables	**N**	$\sum X$	$\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$	**r-cal**
Precise information (X)	200	49.60	49.33	76.80	70.30	73.31	0.69
Lecturers' workload (Y)	200						

Source: Field data, 2023

The data presented in Table 3 shows that the correlation coefficient between potential mitigation strategies and ceramic industry in the South-South region of Nigeriais (r-cal) = 0.698. This value shows that a positive and strong relationship exist between potential mitigation strategiesand industry in the South-South region of Nigeria.This implies that potential mitigation strategies increases, there is an increase in ceramic industry in the South-South region of Nigeria.

Test of Hypotheses

Hypothesis 1: There is no significant relationship between pollutants generated and ceramic practicesin the South-South region of Nigeria.

Table 4: Pearson Product Moment Correlation between pollutants generated and ceramic practices in the South-South region of Nigeria

Variables	**N**	**df**	**r-cal**	**Sig. level**	**P-Value**	**Decision**
Pollutants Generated (X)	200	198	0.63	0.05	0.000	Rejected
Students' Performance (Y)	200					

Source: Field data, 2023

The result in Table 4 shows that r-value of 0.63 at significant level of 0.05 yielded p-value of 0.000. Since the p-value of 0.000 is less than 0.05 significance level, the null hypothesis was rejected. This implies that there is a significant relationship between pollutants generated and ceramic practicesin the South-South region of Nigeria.

Hypothesis 2: There is no significant relationship betweenmethodologies employed in Environmental Impact Assessmentand ceramic practicesin the South-South region of Nigeria.

Table 5: Pearson Product Moment Correlation between methodologies employed in Environmental Impact Assessment and ceramic practices.

Variables	**N**	**df**	**r-cal**	**Sig.**	**P-**	**Decision**

				level	Value	
Methodologies Employed (X)	200	198	0.68	0.05	0.000	Rejected
Ceramic Practices(Y)	200					

Source: Field data, 2023

The result in Table 5 shows that r-value of 0.68 at significant level of 0.05 yielded p-value of 0.000. Since the p-value of 0.000 is less than 0.05 significance level, the null hypothesis was rejected. This implies that there was a significant relationship between methodologies employed in Environmental Impact Assessmentand ceramic practicesin the South-South region of Nigeria.

Hypothesis 3: There is no significant relationship betweenpotential mitigation strategies and ceramic practices in the South-South region of Nigeria.

Table 6: Pearson Product Moment Correlation between potential mitigation strategies and ceramic practices in the South-South region of Nigeria.

Variables	N	df	r-cal	Sig. level	P-Value	Decision
Potential Mitigation Strategies (X)	200	198	0.69	0.05	0.000	Rejected
Ceramic Practices (Y)	200					

Source: Field data, 2023

The result in Table 6 shows that r-value of 0.69 at significant level of 0.05 yielded p-value of 0.000. Since the p-value of 0.000 is less than 0.05 significance level, the null hypothesis was rejected. This implies that there was a significant relationship between potential mitigation strategies and ceramic practices in the South-South region of Nigeria.

CONCLUSION

In conclusion, the study conducted a comprehensive analysis of the environmental impact of ceramic practices in the South-South region of Nigeria. The research revealed a strong positive relationship between pollutants generated and ceramic practices, indicating that as pollutants increase, the effectiveness of ceramic practices becomes challenging. Similarly, a significant positive correlation was found between the methodologies employed in Environmental Impact Assessment and the ceramic industry, as well as potential mitigation strategies and ceramic practices. These findings underline the urgent need for addressing environmental challenges associated with ceramic production in the region.

RECOMMENDATIONS

1. *Ceramic industries in the South-South region should adopt sustainable practices such as eco-friendly raw materials, energy-efficient kilns, and waste recycling to minimize environmental pollution.*
2. *Industries should conduct thorough Environmental Impact Assessments, considering all pollutants generated throughout the entire ceramic production process. These assessments should inform the development of effective pollution control strategies.*
3. *Government bodies should enforce strict regulations on emissions and waste disposal methods. Regular monitoring and inspections of ceramic industries can ensure compliance with environmental standards.*
4. *Invest in research to develop cleaner production technologies in the ceramic industry. Research grants and incentives can encourage the development and implementation of innovative, eco-friendly practices.*
5. *Raise awareness among the public, ceramic industry workers, and stakeholders about the environmental impact of ceramic practices. Education campaigns can promote responsible consumption and support for environmentally conscious businesses.*
6. *Collaborate with international organizations and countries that have successfully implemented sustainable practices in the ceramic industry. Learning from global best practices can accelerate the transition toward eco-friendly ceramic production.*
7. *Establish a system for continuous monitoring of environmental indicators related to ceramic practices. Regular reporting of environmental performance can encourage industries to remain accountable for their impact on the environment.*
8. *Governments can provide incentives such as tax breaks or subsidies for ceramic companies that adopt green technologies and sustainable practices. These incentives can promote the adoption of environmentally friendly methods.*

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