WEALTH CREATION FROM WASTE MANAGEMENT: CHEMISTRY EDUCATION IMPLICATIONS

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Abstract

The disposal and management of waste have become a widespread problem in many developed and developing countries. These results in significant health and environmental problems as a result of these challenges, there is a need to bring up innovations that will be geared towards reducing wastes that are generated by converting these wastes into useful products. The need for Chemistry education is not only paramount but critical to national development. this is because every human activity leads to the generation of one type of waste or another. Chemistry education exposes one to the knowledge required to convert these wastes into useful resources. This paper focuses on Chemistry as a tool for wealth creation from waste management. The impact of Chemistry education in wealth creation was examined. Recommendations were made among which are: that students of Chemistry should be exposed to the techniques of waste processing and management. This can be achieved by integrating waste handling and processing into the curricula of basic science at basic educational levels and Chemistry at the higher level. Also, government and all stakeholders should to show more commitment for the effective and safe management of waste stream. Government and all stakeholders should to show more commitment for the effective and safe management of waste stream.

Keywords: Chemistry education, Waste management, Wealth creation

Introduction

The problems posed by improper and ineffective management of wastes have become issue of global concern over the past decades. In other words, disposal of wastes has become a widespread problem in both urban and rural areas in many developed and developing countries. The challenge of waste management has in recent time occupied researchers such that innovations are geared towards reducing wastes that are generated and converting already generated wastes into useful products. (Okeniyi, Ngozi-Olehi and Njoku, 2011). In Nigeria, piles of wastes are often found by roads, rivers and many other open spaces in cities and this is causing significant health and environmental problems (Imam, Mohamed, Wilson, and Cheeseman, 2008). The rate of waste generation has continued to increase, due to population growth, lifestyle choices, consumption, rapid urbanization, booming economy and technological advancement (Asase, Yanful, Mensah, Stanford and Amponsah, 2019) which has strengthened the need to address this environmental concern. The major problem is that Nigeria is yet to develop efficient ways of waste disposal which are eco-friendly and which and be recycled back into the environment without constituting nuisance to the environment or affecting the health of the biotic component of the eco-system.

Wastes are the materials that are not needed and are not usable economically without further processing. It may be in the form of solid, liquid, and gas. They originate

from the human activities such as agriculture, industry, domestic activities etc. If these wastes remain untreated, it leads to air, water, soil or solid waste pollution. The market generates a variety of wastes for example, corn cobs, vegetable wastes, packaging materials etc. the household wastes also contain other materials such as paper, glass, metal, plastic and other non biodegradable materials and some of them are excellent raw materials for various industries in the country. All these wastes contain a list of valuable resources in the form of Nitrogen, Phosphorus, Potassium and other chemical which are useful (Hammed, Soyingbe and Adewole,2011).

Statistical data as reported in literature by (Ayuba Abd-Manaf, Sabrina and Azmin, 2013) showed that municipal/metropolis waste density ranges from 280 - 370 kg/m^3, while the rate of daily waste generation is about 0.44-0.66 kg/capital/day with an annual generation of 25 million tons. Also, the average individual generates half a kilogram of wastes everyday while businesses can produce up to two kilograms of waste every single day. However, the amount of waste generated on the continent is estimated to grow very far over the coming years (Ogwueleka, 2009).

The importance of Chemistry cannot be overemphasized because the science of Chemistry is presumed to be the fulcrum upon which all other science and technology are attached. (Adedibu, 2012). Environmental degradation, pollution and waste disposal are among the numerous challenges facing Nigeria. Chemistry education is seen as a tool for ameliorating these challenges and bringing about sustainable development in Nigeria. Waste management is one of the numerous agenda of the sustainable developmental goals. Goal 6 is aimed at ensuring sustainability and sustainable management of water and sanitation for all. Also by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated waste water and substantially increasing recycling and safe reuse globally. (UNDP, 2018). This paper therefore aims at unveiling Chemistry education as a tool for wealth creation from waste management.

Environmental and Health Problems Associated with poor Waste Disposal

Waste management in Nigeria is poor, resulting from irregular waste collection and indiscriminate disposal of waste. The impacts of waste on public health and the environment are discussed briefly below:

- Environmental Pollution: One major adverse effect of indiscriminate waste disposal is environmental pollution. The quality of air, soil as well as both surface and ground water is being limited. For instance, under anaerobic condition methanogens (bacteria) can aid the release of methane gas (Amuda, Adebisi, Jimoda and Alade, 2014), as well as CO_2 or both (Ohimain and Izah, 2017) which degrade air quality and also aid the incidence of global warming.
- Environmental Degradation: Unsafe and precarious dumping of untreated solid wastes will automatically lead to environmental degradation. To a great extent unregulated dumping also limit soil productivity for agrarian purpose (Anikwe and Nwobodo, 2002). For instance, solid waste have the ability to block drainage channels which can lead to excessive flooding during precipitation (Oyekan and Sulyman, 2013).
- Health Consequences: A lot of health problems are associated with illicit dumping of wastes. (Oyekan and Sulyman 2015), reported that insects and vectors that transmits major diseases of public health are usually found in dumpsites these vectors play vital roles in the transmission of disease of public health importance like plague, amoebic dysentery, rat bite fever,

Lassa fever etc (Adam*u*, Dibal and Duhu, 2014).

Waste to Wealth: Chemistry Education A Way Out

The need for Chemistry education is not only paramount but critical since every human activity leads to the generation of one type of waste or another. Chemistry and chemical education contribute to more sustainability in our society, today and in future by helping to solve environmental and health problems. One of chemistry's contributions to meeting the challenge of more sustainability in the need of our society is the promotion of a sustainable Chemistry in research and industrial production. For instance, Green Chemistry is a field of Chemistry which aims at making Chemistry more energy efficient at reducing waste disposal and or producing innovative products with less consumption of natural resources. (Eilks and Rauch, 2012).

Furthermore, Chemistry education sensitizes the citizenry on the appropriate collection, transport, processing and disposal of waste materials that gain entrance into our environment. It equips one with the capability of waste recycling and post-use management practices (Okenyi, Ngozi-Olehi and Njoku, 2011). The knowledge gained from Chemistry can be employed in paper recycling. Paper recycling not only saves trees, it also reduces costs by 35 to 50% and decreases water consumption and pollution. Furthermore, recycling old papers uses 60% less energy than manufacturing from new materials and also consumes less chemicals as well as bleaches which is safer for the environment Recycling aluminum cans brings energy saving to 95% and produces 95% less green house gas emissions than when raw materials are used (Okenyi, Ngozi-Olehi and Njoku, 2011).

Chemistry and chemical education is also helpful in converting agricultural wastes to useful resources. The knowledge of Chemistry can be utilized in converting agricultural wastes into raw materials such as animal feed, composting energy and biogas construction etc. The sale of produce from waste, whether by simple use, recycling and recovery or by more complex the technological processing has helped to create jobs appropriate to the socioeconomic conditions of the locality or country.

Statement of the Problem

Wastes have become an important issue in Nigeria, heaps of wastes are often found by roads, rivers and many open spaces in major cities in the country and thus causing significant health and environmental problems. The ancient city of Ibadan is not left unaffected. Ineffective management of waste is a problem in Ibadan due to the population, unplanned civilization and size of the city. In recent times, efforts are been made by the Oyo state government in managing the collection and disposal of waste generated in Ibadan metropolis. Despite these efforts, an emerging trend is the dumping of refuse along the median of some major and collector roads in the city. Also, despite the importance of waste management, urban and environmental managers in Nigeria have not been able to provide a workable, sustainable and permanent solution to the indiscriminate disposal of refuse in major cities. It is in view of this that the study examined how Chemistry education can be used to create wealth creation from waste management.

Objectives of the study

The main objective of the study is to examine how wealth can be creation from wealth management through Chemistry education. And also to examine the negative effect of ineffective waste management and the possible solutions to the problems of ineffective waste management.

Research questions

The following research questions were formulated for the purpose of this study:

1. In what ways can Chemistry education be used for recycling of waste materials to create wealth?
2. What are the negative effects of ineffective waste management?
3. Are there any solution to the problems of ineffective waste management?

Methodology

The research design adopted for the study was a descriptive survey. A well constructed and self- developed questionnaire tagged Waste Management and Chemistry Education Implication Questionnaire (WMCEIQ) was used to access information from the students. The questionnaire was validated by the experts in the field of Chemistry Education. The questionnaire is made up of two sections. Section A focused on the personal data of each respondent while Section B elicited information on Wealth Creation from Waste Management: Chemistry Education Implications. The questionnaire utilized a 4-point scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD). The instrument was administered personally by the researcher and two research assistants. A total of 150 copies of questionnaire were distributed and all (100%) were retrieved. Out of the five rural local governments in Ibadan metropolis three local government areas (Ibadan North, Ibadan North East and Ibadan South East). The face and content validities of the instrument were ascertained. Multistage sampling technique was used to select five (5) areas from each of the three local governments. Fifty (50) respondents were then selected from each area making a total of one hundred and fifty (150) respondents. The data were analyzed using simple percentage.

Results

Research Question 1: In what ways can Chemistry Education be used for recycling of waste materials to create wealth?

Table 1: Ways Chemistry Education be used for Recycling of Waste Materials to Create Wealth

S/N	Items	SA	A	D	SD
1.	Chemistry Education can be used to recycle waste plastic to carpet fibre and plastic sheet building materials	145 (96.3%)	0.0 (0%)	5 (3.7%)	0.0 (0%)
2.	Scrap metals can re melted and re-fabricated to produce Aluminum through Chemistry Education	120 (80.0%)	30 (20.0%)	0.0 (0%)	0.0 (0%)
3.	Waste paper can be re-cycled through Chemistry Education to produce Asbestos/ ceiling board and news papers	150 (100.0%)	0.0 (0%)	0.0 (0%)	0.0 (0%)
4	Plastic wastes can be recycled to make new products	140 (93.0%)	10 (6.7%)	0.0 (0%)	0.0 (0%)

5	Chemistry Education can be used to re-cycled tyres rubber components into bio-oil, synthetic roof slate and concrete building blocks	150 (100.0%)	0.0 (0%)	0.0 (0%)	0.0 (0%)

From Table 1, the respondents identified methods Chemistry Education be used for recycling of waste materials to create wealth. On the statement that says Chemistry Education can be used to recycle waste plastic to carpet fibre and plastic sheet building materials, 145 (96.3%) strongly agreed while 5 (3.7%) disagreed. In addition, all the respondents, 150(100.0%) strongly agreed that waste paper can be re-cycled through Chemistry Education to produce Asbestos/ceiling board and new papers as well as the opinion that says Chemistry Education can be used to re-cycled tyres rubber components into bio-oil, synthetic roof slate and concrete building blocks.

Research Question 2: What are the negative effects of ineffective waste?

Table 2: Negative Effects of Ineffective Waste Management

S/N	Items	SA	A	D	SD
1.	Citizen should be encouraged to practice Eco- responsibility through Reduce, Re-used and Recycle of waste	120 (80.0%)	20 (13.3%)	10 (6.7%)	0.0 (0%)
2.	There should be effective strategy for municipal waste disposal and management	150 (100.0%)	0.0 (0%)	0.0 (0%)	0.0 (0%)
3.	Waste division plans should be put in place	140 (93.0%)	10 (6.7%)	0.0 (0%)	0.0 (0%)
4.	Control and monitoring of land tiller and fly-tipping activities	100 (66.6%)	50 (33.3%)	0.0 (0%)	0.0 (0%)
5.	Enforcement of laws and regulation on waste disposal	I50 (100.0%)	0.0 (0%)	0.0 (0%)	0.0 (0%)

From Tale 2, the respondents commented on effects of ineffective waste management. On the statement that says citizens should be encouraged to practice Eco- responsibility through Reduce, Re-used and Recycle of waste, 120 (80.0%) strongly agreed, 20 (13.3%) agreed while 10 (6.7%). Also, on the motion that waste division plans should be put in place, 140 (93.0%) while 10 (6.7%) agreed with the statement. In addition, all the respondents, 150 (100.0%) strongly agreed that enforcement of laws and regulation on waste disposal.

Research Question 3: Are there any solution to the problems of ineffective waste management?

Table 3: Solution to the Problems of Ineffective Waste Management

S/N	Items	SA	A	D	SD
1	Environmental pollution occur as a result of ineffective waste management	150 (100.0%)	0.0 (0-00%)	0.0 (0.00%)	0.0 (0.00%)
2	Improper waste management can lead to environmental degradation	100 (75.0%)	30 (20.1%)	20 0.0 (13.4%)	0.0 (0%)
3	Dysentery, cholera and digestive infection can be transmitted due to effective waste management	150 (100.0%)	0.0 (0.00%)	0.0 (0.00%)	0.0 (0.00%)
4	Flooding occurs as a result of indiscriminate waste disposal along the water channel	120 (88.4%)	20 (13.4%)	10 (6.7%)	0.0 (0%)
5	Soil productivity is limited as a result of unregulated dumping of waste	100 (75.0%)	50 (25.0%)	0.0 (0.00%)	0.0 (0.00%)

From Table 3, displays the solution to the problems of ineffective waste management as suggested that respondents. All the respondents 150 (100%) pointed that eenvironmental pollution occur as a result of ineffective waste management. More so dysentery, cholera and digestive infection can be transmitted due to effective waste management. On the statement that improper waste management can lead to environmental degradation, 100 (75.0%) strongly agreed, 30 (20.1%) agreed while 20 (13.4%) disagreed with the view. 120 (88.4%) supported the fact that flooding occurs as a result of indiscriminate waste disposal along the water channel, 20 (13.4%) agreed while 10 (6.7%) disagreed the view.

Discussion of Findings

Table 1 acknowledged methods Chemistry Education can be used for recycling of waste materials to create wealth. Majority were in agreement that Chemistry Education can be used to recycle waste plastic to carpet fibre and plastic sheet building materials, waste paper can be re-cycled to produce Asbestos/ ceiling board and news papers as well as the opinion that Chemistry Education can be used to re-cycle tyres rubber components into bio-oil, synthetic roof slate and concrete building blocks. This is in view with the opinion of Okenyi, Ngozi-Olehi and Njoku, 2011 that Chemistry education equips one with the capability of waste recycling and post-use management practices. Also, the knowledge gained from chemistry can be employed in paper recycling.

Table 2 displays the problems of ineffective waste management. All the respondents pointed that environmental pollution occur as a result of ineffective waste management. More so dysentery, cholera and digestive infection can be transmitted due to effective waste management as well as the improper waste management can lead to environmental degradation. Also, flooding occurs as a result of indiscriminate waste disposal along the water channel

This study corroborated the views of Imam, Mohamed, Wilson, and Cheeseman,

2008 that piles of wastes that are often found by roads, rivers and many other open spaces in cities causes significant health and environmental problems.

Also, the respondents remarked on the solution to poor waste management, they pointed that ccitizens should be encouraged to practice Eco- responsibility through Reduce, Re-used and Recycle of waste as well as waste division plans should be put in place. In addition, all the respondents agreed that laws and regulation on waste disposal should be enforced, there should be effective strategy for municipal waste disposal and management and that control and monitoring of land tiller and fly -tipping activities.

This study is in line with the previous studies of UNDP, 2018) that by 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated waste water and substantially increasing recycling and safe reuse globally.

Conclusion

Waste management in national development is an issue for concern as wastes are generated with increased technological advancement, population growth, lifestyle choices, consumption, rapid urbanization, booming economy. The place of Chemistry education in waste management and wealth creation is indispensible. Proper application of knowledge from Chemistry in waste management will help to protect the environment from health and environmental hazards associated with waste disposal. It also helps to conserve energy and much needed resources. The environment and the economic state of the nation will improve through wealth creation from wastes. Finally, Chemistry and chemical education contribute to more sustainability in our society, today and in future.

Recommendations

Having identified that Chemistry education is an essential tool in waste management, the following recommendations were made:

- Students of Chemistry should be exposed to the techniques of waste processing and management by integrating waste handling and processing into the curricula of basic science at basic educational levels and Chemistry at the higher level.
- Government and Non-Governmental organizations should give financial assistance to graduates of Chemistry who are willing to apply knowledge gained into converting wastes generated from our environment into useful products that are of economic benefit
- Government and all stakeholders should to show more commitment for the effective and safe management of waste stream.
- Government on one hand should provide recycling and treatment facilities for effective management of wastes, and effective legislation on the other hand in order to deter precarious dumping.
- The populace should be sensitized on safe and eco-beneficial management of waste including recycling, waste to wealth policy

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