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# Palm Bunch Management and Disposal as Solid Waste and the Stabilization of Olokoro Lateritic Soil for Road Construction Purposes in Abia State, Nigeria

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**Abstract**

Palm bunch management and disposal as solid waste have been studied for the amount discharged from selected palm oil mills in Abia State. The process of personal interviews was conducted and responses evaluated and tabulated. A correlation was drawn between the responses and previous research work on the use of palm bunch ash as admixture in the stabilization of soil for road construction works in Abia State. Palm bunch as solid waste has proven to be a good material in both ash and nanosized ash additive to soil in improving its strength properties which satisfied the standards for the materials' use in pavement construction and rehabilitation. The results have encouraged the Ministries of Environment and Works to collaborate in this task to convert solid waste to usable materials in Geoengineering and "Geowaste" Engineering.

**Keywords:** Palm bunch; Management; Disposal; Solid waste; Stabilization; Lateritic soil; Road construction

## Introduction

Palm bunch is a product of palm oil production and processing from agro industries and local farmers whose concentration is the processing and production of palm oil. The task of palm bunch management and disposal has been a huge one except for its use as biofuel; a process that has helped in reducing the quantity of bunch indiscriminately disposed on the streets every day [1]. With the introduction of Geowaste Engineering, the disposal and management of palm bunch as a solid waste has gained interests. "Geowaste" Engineering is the area of Geoenvironmental Engineering where solid waste materials are used to improve the mechanical and Geotechnical properties of lateritic soil used in pavement constructions. Nigeria as a developing country whose hope of breaking loose from the shackles of underdevelopment, has been faced with solid waste disposal and management problem [2,3]. This is primarily because we lack the technologies and expertise to recycle and reuse these waste materials. Over the years, researches have shown that palm bunch could be used in the stabilization of lateritic soil, which is used in different Geotechnical engineering works. While we are faced with the hazards of dumping a palm bunch on our environment, we are equally faced with a dilapidated and failed environment with respect to facilities and structures that could be saved with these same waste materials. In 2015, a research was carried out to evaluate the effect of palm bunch ash on the Geotechnical properties of lateritic soil used for construction purposes and results showed significant improvements on the mechanical and Geotechnical properties of soil when mixed with varying proportions of palm bunch ash [4]. In 2016, an extended research work was also conducted on the effect of nanosized palm bunch ash on the Geotechnical properties of lateritic soil used for the same purpose. The results also showed great improvements in the soil properties which satisfied engineering standards for use as admixture in the stabilization of the soil for Geotechnical engineering works [5-8]. Consequently, the aim of this research work is to evaluate the need for efficient disposal and management of palm bunch and its use in the soil improvement for road pavement construction and rehabilitation and other Geo-engineering works in Abia State [9-15].

## Methodology

Abia State is located on latitude 5.4309° N and longitude 7.5247° E covering an area of 6, 320 km$^2$ with an average rainfall of 2050 mm. Abia State has a variety of land forms, despite the fact that it is dominated by flat and low-lying land, generally less than 120 m above sea-level. The low-lying plain is the inland extension of the coastal plain from the Bight of Benin [16-22]. The central part of the state is characterized by undulating land with many hills. The highland areas are part of the Enugu - Nsukka - Okigwe cuesta. This area has an average height of between 120 m and 180 m above sea-level. From Okigwe (Imo State), this escarpment extends in a west-east direction and, on getting to Afikpo (Ebonyi State), veers southeastwards to Arochukwu where it terminates. Palm tree farming and palm oil processing and production are the major activities of the people living within the studied area. As a result, palm oil milling factories and farms are predominantly located in every village within the state of Abia. The waste products of these factories are palm bunch, palm kernel, palm leaves, etc., which are disposed indiscriminately along pathways, roads and even on farmlands making its use a difficult task. The present research has sampled through questionnaires the average yield of few selected palm oil mills in Abia State and come up with the results of their responses which will help the state ministry of environment to establish modalities on how to manage these solid waste materials in collaboration with the state ministry of works. The selected palm oil mills are located in Ndiolumbe, Omoba, Nbawsi, Ohafia, Arochukwu, Obohia and Ndoki all in Abia State. The management of these palm oil mills were interviewed on the quantity of palm bunch they produce daily and their disposal procedures. At the end of the exercise, results were collected and tabulated.

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| Palm Oil Mill | Ndiolumbe | Omoba | Nbawsi | Ohafia | Arochukwu | Obohia | Ndoki |
|---|---|---|---|---|---|---|---|
| Palm Bunch Discharge Quantity (Tonnes/day) | 342 | 192 | 157 | 118 | 87 | 120 | 97 |

**Table 1**: Daily discharge of palm bunch from palm oil mills in Abia state.

| Discharge Point | Biofuel | Farmland | Road Sides | Drains | Dilapidated Road Points | Organic Fertilizer | Solid waste Bins | Uncertain |
|---|---|---|---|---|---|---|---|---|
| Tonnes/day | 520 | 21 | 146 | 136 | 201 | 23 | 53 | 19 |

**Table 2**: Daily disposal of palm bunch from palm oil mills in Abia state.

## Results and Discussion

From the seven selected Palm Oil Mills in Abia State, a total of 1113 tonnes of palm bunch is discharged and disposed daily as shown in Tables 1 and 2. It can be observed that the palm oil mills in the southern part of Abia and close to the rural and suburb communities produce the highest amount of palm bunch. The daily discharge of palm bunch from the selected oil mills in Abia State is a clear indication of the amount of solid waste disposed indiscriminately that should be put into engineering use to save our environment. Among the hazards of indiscriminate disposing this solid waste are; (i) blocking rural and urban roads where these wastes are dumped, (ii) blocking drain facilities, thereby making them non-functional, (iii) puncturing of vehicle tyres and also making the roads untidy to be used, iv) rendering farmlands useless to intended use, and (v) occupying the waste bins unnecessarily. It can also be observed that the highest quantity is used as a biofuel in homes and the same oil processing factories to boil the palm fruits during processing. This is because all the oil mills don't have access to industrial boilers used to boil palm fruits during processing. The above mentioned hazards could be mitigated if the ministries of Environment and Works had come together to collaborate on the management and discharge of solid waste in Abia state under a procedure I would call "waste to safety" of our decaying environment. There is plenty to be achieved with this procedure; (i) save our farmlands, roadways, drains, waste bins and more by ridding the environment of this solid waste and pushing them into the stabilization of soil for Geotechnical engineering purposes. The subgrade soils of our flexible pavements fail in different parts of the state when we can actually improve the strength characteristics of the lateritic soil used as subgrade soils by using palm bunch ash as admixture to the stabilized soil and ordinary Portland cement as the binder [23-28]. Previous research has shown that the addition of 15% of Palm Bunch Ash by weight of the stabilized sample is suitable to improve the strength properties of the stabilized soil and the addition of 12% of Nanosized Palm Bunch Ash is also suitable for the same purpose. It follows that if the entire palm bunch generated in this state from palm oil processing, the environment will be free of this solid waste and at the same time get better in terms of pavement facilities' strength improvement.

## Conclusion

From the foregoing, we can deduce that the management and disposal of palm bunch and reusable solid waste generated in Abia State is a combined activity of the Ministries of Environment and Works in that both government agencies have a need for this solid waste to make our environment better in both lines.

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