Effects of Oil Palm Wastes on the Environment in Edo and Ondo States, Nigeria

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Abstract:- The study assessed the effects of Oil Palm wastes on the environment in Edo and Ondo States Nigeria. specifically, the study ascertained the socio-economic characteristics of the processors, assessed the disposal of oil palm fruit processing wastes and the effect of the waste on the environment was also determined. A multi-stage sampling procedure was used in the selection of 250 respondents for the study. Data were collected with the use of interview schedule. Data collected were subjected to both descriptive and inferential statistics; descriptive statistics included frequencies, percentages and means. Inferential statistics used was Chi-square.

The results showed that majority of the respondents (72.2%) were males, married (89.6%), had mean age of 49.18 years educated (92.4%). Majority of them (57%) operated small mechanized mills with digester, with a few (12%) having mechanized mills. and had mean processing experience of 10 years. Also, respondents' perception on waste significantly associated with the different disposal methods at $p \leq 0.05$. It was concluded that oil palm processors were mostly males they employed open dumping and burning of their wastes. The study recommended female processors should be encouraged and more appropriate ways of disposing wastes should be encouraged by oil palm stakeholders.

Keywords:- Oil Palm, Wastes, Disposal, Environment.

I. BACKGROUND TO THE STUDY

Oil palm ((*Elaeis Guineensis* Jacq)) stands out as one of the most important food security crops for Nigeria mainly because of its usefulness (Akangbe, adesiji, Fakayode and Aderibigbi 2011). Oil palm is a native of the humid tropics of West Africa and one of the major oil crops in the world, producing more oil than all other oil plants. (Adeoluwa and Adeoye, 2008). It is one of the most important products in Nigeria which helped to change the scenario of its agriculture and economy in the 1950s and 1960s. (Oviasogie, Aisueni and Brown, 2010).

The oil palm as already noted is one of the cash crops of the country, which has greatly contributed to the economic development of Nigeria. Before the discovery of crude oil in the 1970s, Nigeria was a leading producer of palm produce in the world during the period, 1948 -1963. Palm produce accounted for about 52.1 % of the total

Nigeria's domestic export between 1906 and 1913 (Usoro, 1974 as cited in NIFOR, 2015). Oil palm earned the nation about 22% of the foreign exchange up to 1966 (Modebe, 1978 as cited by NIFOR, 2015).

Over the years, there has been concerted effort by the government of Nigeria to increase oil palm production to meet the increasing demand. According to reports by BusinessDay (2013), "the government is taking conscious strong measures to revive the industry. It has rolled up its sleeves to increase considerably the land under cultivation and also is all set to increase the per hectare production.

The oil palm is a crop of major economic importance. The increased interest in this sector (Emefiele, 2015), is likely to encourage many more people to go into the oil palm sector which will ultimately increase production. The oil palm industry has a long value chain of which one is processing.

➢ *The Specific Objectives were to:*

- ascertain selected socio-economic characteristics of the oil palm fruit processors in the study area;
- ascertain the disposal of some oil palm fruit processing wastes;
- determine the perceived effect of the wastes on the environment.

➢ *Hypothesis*

- *H0[1]: There is no significant association between perceived effects of waste on the environment and disposal methods of some selected wastes.*

II. METHODOLOGY

➢ *The Study Area*
The study was carried out in Edo and Ondo States, Nigeria.

➢ *Edo State*
Edo State is situated in the South-South geopolitical zone of Nigeria, created on the 27th of August, 1991 out of the old Bendel State. Edo State lies between longitudes 05 04^{01}E and latitudes 05^{0}44^{1}N and 07^{0}34^{1}N. State is generally a low-lying area except in the north where it is marked by

undulating hills. The State is made up 18 local Government Areas, and is divided into three (3) Agro Ecological Zones as delineated by the Agricultural Development Programme (ADP). The agro-ecological zones are Edo South, Edo Central and Edo north. Edo South consists of seven extension blocks or local government areas; Edo Central comprises six (6) blocks or local government areas and Edo North consists of five (5) blocks or local Government Areas.

➤ *Ondo State*

Ondo state is one of the second-generation states created on February 3rd 1976 out of the old Western Nigeria. It is situated in the South Western part of Nigeria and its capital is Akure. Ondo state lies between longitude $4^0 3^1$ and 6^0 East of the Greenwich Meridian, $5^0 4^1$ and 8^0 North of the Equator. Ondo State lies entirely in the tropics where humidity is relatively high with annual temperatures ranging between 210C -29^{0}C.

The state is made up of four (4) ADP Zones which are Ondo, Owo, Ikare and Okitipupa Zones. Ondo zone is made up of six (6) ADP blocks, Owo has four ADP blocks, Ikare comprises four (4) blocks and Okitipupa which consists of four ADP blocks. Agriculture is also a major occupation in the State.

➤ *Sampling Procedure*

The target population consisted of all small-scale oil palm processors in Edo and Ondo States. For the purpose of these study, the definition of small scale processors is all processors with production capacity of about 5 tonnes of fresh fruit bunch (FFB)/ Hr as adapted from NIFOR Small Scale Processing Equipment(SSPE) quotation (2021).The States ADPs, major stakeholders such as state chairmen of Palm Oil Producers Association of Nigeria (POPAN), Oil Palm Growers Association Nigerian (OPGAN), National Palm produce Association of Nigeria (NPPAN)and NIFOR will be used for easy identification of the respondents as well as their locations.

A multi-stage sampling procedure was used in the selection of respondents for the study. The first stage involved a purposive selection of Edo and Ondo States from the oil palm producing states in Nigeria. This is because Edo and Ondo States are areas of intensive oil palm cultivation and processing. The second stage also involved a purposive selection of six ADP blocks from the three (3) agro-ecological zones of Edo State and six blocks from the four (4) agro-ecological zones of Ondo State. Making, a total of 12 blocks, which gives at least one–quarter of the total blocks in the ADP blocks in the two States. The third stage involved a simple random selection of ten (10) percent of all registered respondents from an aggregate list of registered oil palm processors with the ADPs and association chairmen in the two States. A total of 250 oil palm processors were interviewed.

III. MEASUREMENTS OF VARIABLES

➤ *Socio-Economics Characteristics:*

● *Sex: -*
Respondents were required to indicate their sex. Male =1, or female = 2. This was measured on a nominal scale.

● *Age: -*
Respondents were required to state their actual age in years. This was measured on interval scale.

● *Marital Status: -*
Respondents were asked to indicate their marital status; single =1, married=2, divorced=3, widowed=4 and separated=5. It was measured on a nominal scale.

● *Educational Attainment: -*
Respondents were asked to indicate their educational attainment from a list of varied levels of education ranging from no formal education to obtaining tertiary education. These variables were measured on an ordinal scale. No formal education (0), primary school attempted (1), primary school completed (2), secondary school attempted (3), secondary school completed (4), Tertiary school attempted (5) and Tertiary school completed (6).

● *Processing Experience: -*
Respondents indicated their years of experience with regard to oil palm processing. This was measured at interval scale.

● *Income Generating Activities: -*
Respondents were asked to indicate other income generating activities they engage in apart from processing. This was measured on a nominal scale.

● *Membership of Social Organization:*
Respondents indicated (Yes) for membership and (No) for non-membership. It was measured on a nominal scale. They were further asked to indicate type of organization from a list of options provided if they had indicated Yes, also measured on a nominal scale.

➤ *Perceived Effects of Oil Palm Waste on the Environment*
List of environmental effects of oil palm processing waste were provided for the respondents from which they indicted the degree of the effect on 4- point Likert-type scale of; not an effect (1), less serious effect (2), serious effect (3) and very serious effect (4). The weighted mean was computed and further ranked to determine the degree of the effects.

➤ *Method of Data Analysis*
Data collected were analyzed using descriptive statistical tools such as frequency distribution, percentage, means, and charts, while inferential statistical tools included the Chi square (x^2).

➢ *Hypothesis Testing*

• *H0₁: There is no significant association between perceived effects of waste on the environment and its disposal methods; was analyzed using Chi-square.*

IV. RESULTS AND DISCUSSION

• *Socio-Economic Characteristics of Respondents*

• *Sex*

The results in Table 1 showed that 72.8% were males and 27.2% were females, which implies that males were more predominantly involved in oil palm processing activities than their female counterparts in the study area. This is contrary to the findings by Adelakun et al. (2016), Obayelu et al. (2022), that the majority of oil palm processors were females. This may be as a result of the drudgery involved in the work; even in the female owned mills, personal observation and in-depth enquiry revealed that the work was usually done by employed males leaving the female owners as supervisors to ensure smooth running of the mills.

• *Marital Status*

The results in Table 1 showed that 89.6% of the oil palm processors were married, 5.6% were widowed, 4.8 % were single while 0.8 % were divorced; which means that the majority of the oil palm farmers were married. This shows that the marriage institution is highly regarded in the study area. This could also be a major determinant by the respondents for going into oil palm processing to increase the family income since there is a high demand for palm oil and palm kernel oil for, cosmetic, pharmaceutical and other uses as well as promoting good health; This also implies that the respondents are likely to have additional family responsibilities.

• *Age*

The results in Table 1 showed that 29.0% are between 51-60 years, 41-50 years (27.0%). 61-70 years (16.4%), 31-40 years (8.4%) while the least (6.4%) fell between 21-30 years. This suggests that, the most active age bracket of the respondents in the study area was between 51-60; with a mean age of 49.18 years, which indicates an economically productive active age of the oil palm processors in the study area. This agrees with previous findings of Soyebo, Farinde and Dionco-Adetayo (2005), who had revealed that majority of farmers are in their active age, implying that this group of farmers are more involved in processing of oil palm than other age groups in the study area.

• *Household Size*

The results in Table 1 showed that 9.2% of the respondents had a household size of 1-3, 56.4% had 4-6, 28.0% had 7-9, 5.6% had 10-12 while the least percentage (0.8%) of the respondents had a household size of over 12 persons.; with a mean of 6 persons per household. This shows that the respondents had fairly large household sizes, which implies available production labour which can be used by the processors in their daily production activities. These findings were in line with Ahmadu and Ojogho (2012) in Edo state.

• *Years of Experience in Processing Location*

The results in Table 1 showed that 57.6% of the respondents had between 1-10 years of experience, which show the highest percentage of processing experience in the location, while 29.2% of the farmers had between 11-20 years of processing experience, 12.4% had been processing in that location for 21-30 years, while only 0.8% had been processing in their location for 31-40 years in the location. Most of the farmers have been processing in this location for 1-10 years; with a mean processing experience of 10 years. This implies that most of the processors had relative experience in oil palm processing which could help them in effective management decisions in terms of input utilization, labour use and allocation of their resources in the locality for maximum benefit. It also means that their activities have impacted on their environment for a reasonable length of time.

Table 1 Socio-Economic Characteristics

Variables	Frequency	Percentage	Mean
Sex			
Male	182	72.8	
Female	68	27.2	
Marital status			
Single	10	4.0	
Married	224	89.6	
Widowed	14	5.6	
Divorced	2	0.8	
Age of respondents			
21 – 30	16	6.4	
31 – 40	46	18.4	
41 – 50	69	27.6	
51 – 60	73	29.2	49.18 years
61 – 70	41	16.4	

71 – 80	5	2.0	
Household size			
1 – 3	23	9.2	
4 – 6	141	56.4	
7 – 9	70	28.0	
10 – 12	14	5.6	6 persons
Above 12	2	0.8	
Years of processing experience in this location(years)			
1 -10	143	57.6	
11 – 20	74	29.2	
21 – 30	31	12.4	
31 – 40	2	0.8	

Source: Field survey, 2022

➤ *Disposal Method for EFB*

The result also showed that EFB is mostly disposed by open dumping and open burning accounted for by about 38.0%, respectively; 7.6% of the respondents bury the EFB and 0.8 dispose by using it for landfills. The dumping and burning of EFB is said to create environmental pollution problems because incineration emits gases which are harmful to health and environment in line with Embrandiri et al., (2013) who noted that burning of EFB affects the environment negatively by polluting the air. This is in line with Zakri and Adams (2021) observation that most of the EFB that were produced from palm oil mills were used for boiler fuel, incinerated or returned to the plantations to be used as mulching. Using of EFB as landfill could impact on the soil as found by Liana et al., (2019), who observed that it creates issues of soil toxicity and eutrophication. The implication is that random disposal of EFB could have very negative impact on the environment which could directly or indirectly affect the living population. However, EFB have been found to be of great economic benefit; as compost and organic fertilizer, (Zakri and Adam, 2021), as substrate for the cultivation of mushroom, (Kavitha *et al*., 2013), who also noted that improperly managed EFB by way of indiscriminate dumping causes additional methane emissions into the atmosphere. Also, EFB can be pulped for use in the paper industry, (Sunday, 2022) among many other uses
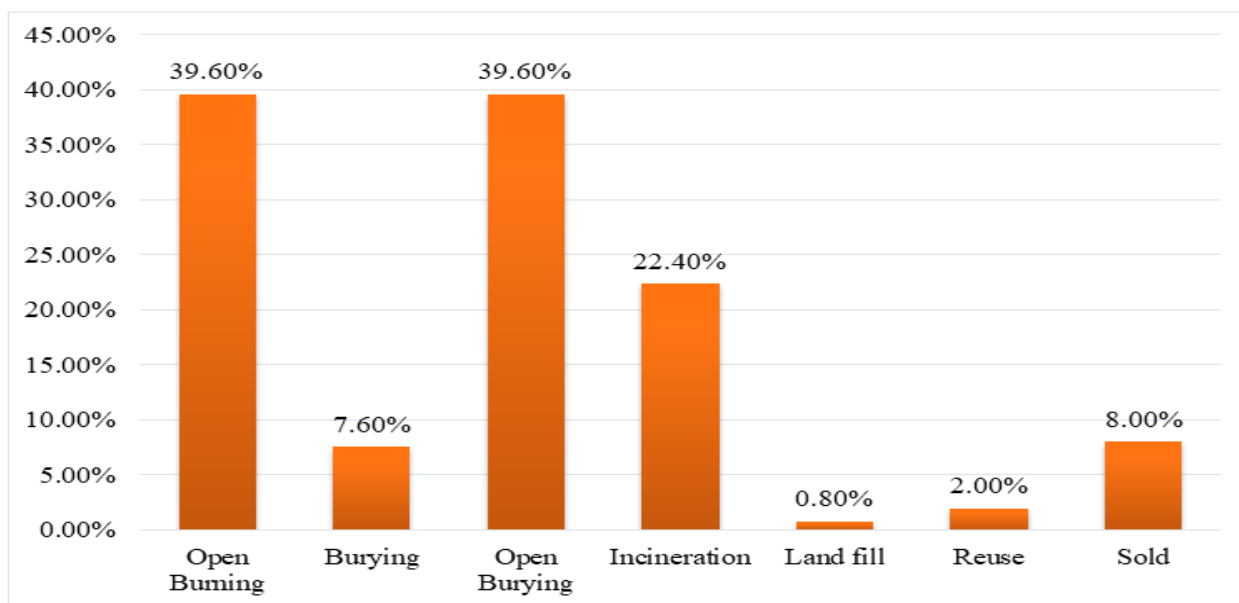

Fig 1 Disposal Method for EFB
Source: Field survey, 2022

➤ *Disposal Method for POME*

The major disposal method for POME as shown in Figure 2 is discharging it in the bushes or plantations as affirmed by 27.0% of the respondents, which agrees with the findings of Orji *et al*.,(2014) that the palm oil mill effluent generated is poured away into available pieces of land near the mill, 23.6% of the respondents agreed to discharging POME into sludge pits, while 14.0% of the respondents channeled POME into rivers. The implication of this is that it is difficult to dispose POME and as such processors contaminate the environment by disposing it in the bushes and polluting the water bodies making it unsafe for drinking and other economic activities; and harmful to aquatic life. Hartley (2004), had earlier raised this concern in his observation that POME discharged from an oil mill is objectionable and pollute streams, rivers or surrounding land.
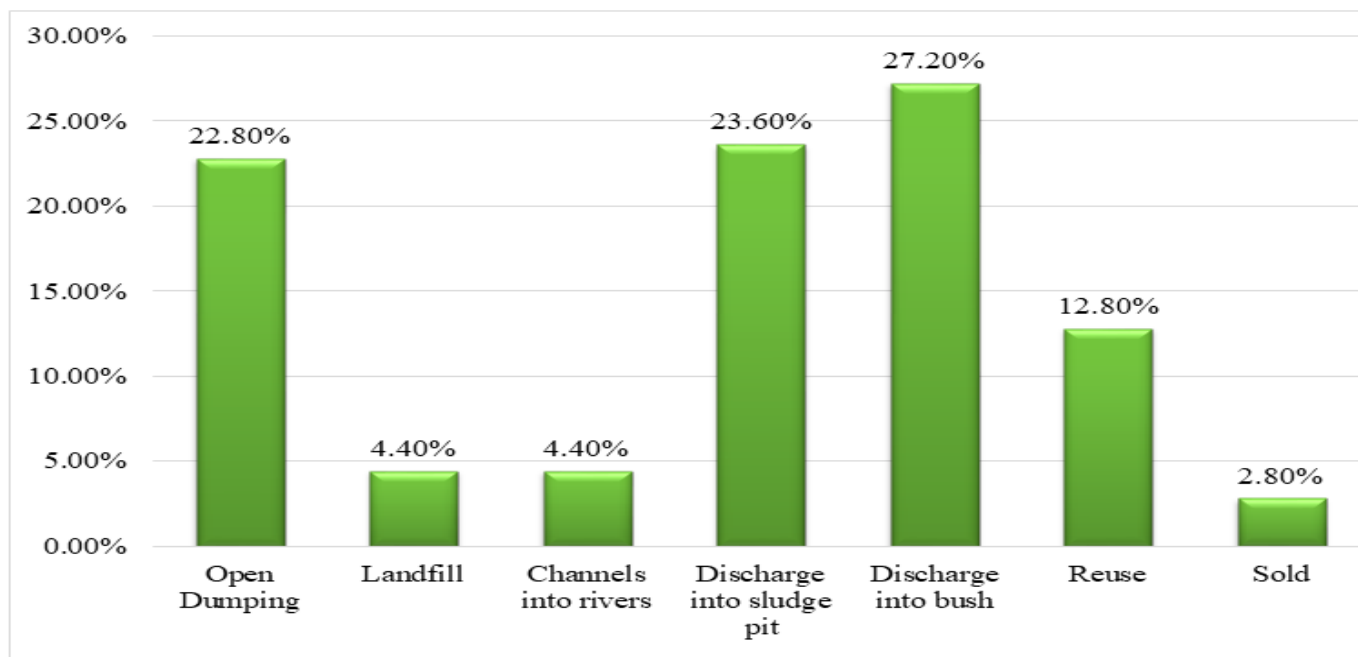
Fig 2 Disposal Method for POME
Source: Field survey, 2022

➤ *Disposal Method for Palm Kernel*

As shown in Figure 3 palm kernel is mainly sold by the respondents after oil palm processing which accounts for about 25.5%. This income generated from this is likely to meets some family financial needs reducing the burden on the family's main income source which would in turn increase the family's standard of living and living conditions generally reuse the palm kernel for other social needs, while 22.4% openly dump the palm kernel. Selling off the kernel and reusing it not only provides additional income for the family, but also reduces the deleterious effect of indiscriminate dumping and burning that would have been the alternative means of disposal. Viewed in this light, one can safely say wastes can either become pollutant or wealth, depending on what you choose to do with it.
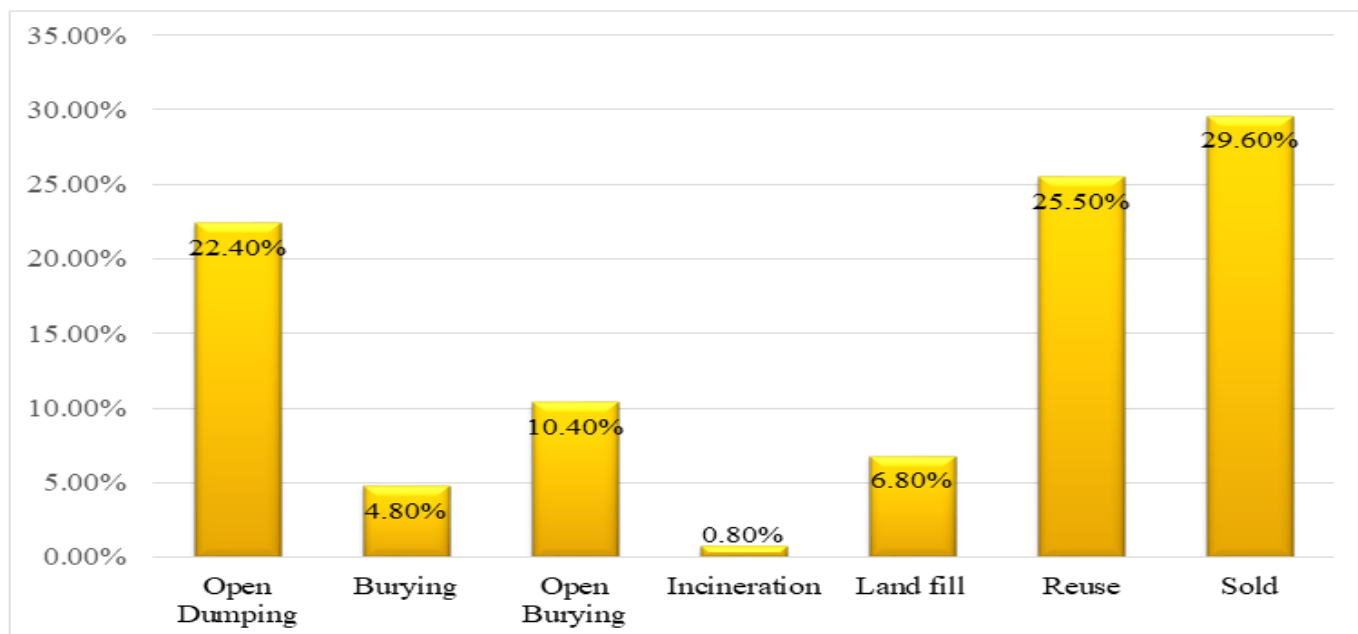

Fig 3 Disposal Method for Palm Kernel
Field survey, 2023

➤ *Perceived Effect of Oil Palm Wastes on the Environment*

Table 2 shows the distribution of the response of respondents with respect to the effects of waste on the environment. As shown on the table, all the effects listed were perceived impacting the environment as effects, apart from dumping of oil palm waste indiscriminately which in turn tends to improve soil fertility ($\bar{x}$ =1.9). This could suggest ignorance of the respondents of the positive effects of some of the oil palm wastes on the soil.

Santos, (2018) Achoja et al., 2019; Zakari, and Adams, 2021, Ogunbode and Aliko, 2022) submitted that they can be very useful raw materials for other useful products; and indeed can even enrich the environment if properly harnessed and managed. However, some ranked higher than others. For, example, contaminating drinking water if it is channeled into streams, wells or springs ($\bar{x}$ =3.6). Burning

wastes can cause air pollution ($\bar{x}$ = 3.3), Piles of oil palm processing waste leads to a dirty environment ($\bar{x}$ =3.3) were most significant. Other notable effects were empty fruit bunches, press cake, palm oil mill effluent can cause environmental pollution ($\bar{x}$ =3.2).

The implication is that the processors are well aware of the effects of improper management of the waste they generate in the course of processing. It could be that they discard the wastes on the environment because it is the most convenient method of disposal for them. The management method they practice may be as a result of unavailability of adequate man-power and or poor equipment; it could also be attributed to people's general poor behaviour and attitude to sanitation.

Table 2 Perceived Effects of Wastes on the Environment

Effect	Not an effect	Less serious effect	Serious effect	Very serious effect	Mean	Rank
Contaminate drinking water if it flows into streams, wells or springs	5(5)	12(24)	61(183)	172(688)	3.6	1st
Burning wastes can cause air pollution	11(11)	23(46)	105(315)	111(444)	3.3	2nd
Piles of oil palm processing waste leads to a dirty environment	5(5)	1836()	130(390)	97(388)	3.3	2nd
Toxic compounds like nitrous cycle and carbon monoxide are released during the burning of oil palm wastes	6(26)	23(46)	134(402)	87(348)	3.2	4th
Nitrates seepage from oil palm cause water pollution	10(10)	25(50)	131(393)	84(339)	3.2	4th
Empty fruit bunches, press cake, palm oil mill effluent can cause environmental pollution	12(12)	26(52)	105(315)	107 (428)	3.2	4th
The waste can encourage soldier ants and termite infestation	14(14)	40(80)	108(324)	88(325)	3.1	7th
Stench from dump sites can cause environmental pollution	16(16)	26(52)	134(402)	74(296)	3.1	7th
Air pollution results from burning of oil palm processing waste	1515)	34(68)	106(318)	95(380)	3.1	7th
Stench/odour from decaying oil palm processing wastes released to the environment causes discomfort	4(1.41)	38(72)	139(417)	69(276)	3.1	7th

Source: Field survey, 2022

• *H0₁: There is no significant association between the perceived effects of waste and its disposal methods*

Results of the Chi square analysis as shown on Table 3 reveals that at $p \leq 0.05$, respondents' perceived effects of wastes on the environment was significantly associated with all the different disposal methods used in the disposal of various oil palm processing wastes.

The significant association between perceived effects of wastes on the environment and the methods of oil palm processing waste disposal suggests that respondents perceived that effects of oil palm wastes on the environment were significantly associated with disposal methods. This implies that the poorer the waste method disposal employed the higher the effects of the wastes on the environment and vice versa.

Table 3 Perceived Effects of Waste and its Disposal Methods

Variable	χ^2 Value	df	p-value	Decision
Palm kernel	13.18	6	0.04*	S
POME	16.26	6	0.01*	S
Empty Fruit Bunch	18.04	6	0.01*	S

≤ 0.05
*Significant at 0.05 level of significance
S – Significance

V. CONCLUSION

> *Consequent Upon the Findings of the Study, the Following Conclusions Could be Made:*

Majority of oil palm processors in the study area were males; generated a significant quantity of oil palm processing wastes; mostly disposed their wastes by open dumping and burning on the environment; posing a threat to environmental sustainability while incurring losses from what has the potential to become wealth by becoming raw materials for other useful products.

RECOMMENDATIONS

- There is the need to encourage more female processors by way of incentives
- the processors should be educated on the benefits of more sustainable management practices.
- There is need for further studies on local uses of oil palm processing wastes that do not require high tech complex equipment to minimize wastage and for environmental sustainability.

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