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ASSESSMENT OF USED OIL MANAGEMENT AT THE FILLING STATIONS WITHIN MAKINDYE DIVISION IN KAMPALA

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ABSTRACT: *This study investigates the disposal of used oil produced from different sources at the filling stations, and attempts to identify policy gaps and suggest remedial measures. Uganda does not have clear policy guidelines and regulations on used oil collection, storage and disposal, which leaves room for inconsistencies of disposal methods. Used oil contains hazardous heavy metals like lead and mercury, as well as persistent organic substances with the potential to degrade the environment and pollute water sources and the soils which support food production. Six types of filling stations were selected for data collection. Data collection involved asking the management at each filling station for information on record of used oil sources, volume in litres, frequency of collection, means of storage and disposal of all used (waste) oils in the past one month. The results show that motor vehicles are the single most important sources of used oil in Kampala. Some filling stations mix used oil from petrol cars and diesel cars, and only 25% separate them completely in different cans or drums. Level of awareness regarding used oil disposal methods is still very low. A few respondents knew about recycling of used oil. To reduce environmental exposure to risks of used oil, collection and storage at the filling stations are important links to effective monitoring plan. Therefore, there is need to develop simple and cost-effective storage and pre-disposal treatment equipment to reduce possible leakage into the environment.*

KEYWORDS: Used Oil Management, Filling Stations, Oil Disposal, Oil Leakage, Uganda

INTRODUCTION

According to previous research by Zitte et al (2016), used oil is described as dirty oil, black oil, burnt oil, old oil removed from vehicles, oil from engines that is used and used oil product removed from the engine after being used for a period of 2-5 months. Oil is a synthetic lubricant used in automobile engines, generators and other machines. It is one of the most dangerous sources of pollution (Zitte et al, 2016). Once motor oil is drained from an engine, it is no longer clean because it has picked up materials, dirt particles, and other chemicals during engine operation. The lubricating oil is now classified as used oil (Zitte et al, 2016).

According to the United State Environmental protection Agency (EPA, 1996), used oil is defined as any oil that has been refined from crude oil or any synthetic oil that has been and as a result of such use, is contaminated by physical or chemical impurities.

Used oil as one of the wastes from automobile engines have contribute immensely towards the degradation of the environment and the problem of this has been traced to the poor handling of used oil and the ignorance of the major disposers of this used-oil (Zitte et al, 2016). In Nigeria for example, out of 20 automobile mechanics interviewed in the Zitte et al (2016), 60% admitted that they dispose of used-oil on the land, 30% said that they sell it and only 10% acknowledge that they reuse it. On the issue of awareness about recycling, 50% admitted that they are aware, 30% claimed ignorance while 20% do not see the need for recycling. While considering storage method, 55% said that they do not store used oil, 25% store it in a metal drum, and 20% store in plastic drum. The mechanics estimated that about 418 cars are serviced weekly and a total of 1628.50 liters of used-oil are produced. For this result it is worth knowing that indiscriminate disposal of used oil as is commonly (Zitte et al, 2016).

Several countries in the world have put in place, policies and plans to manage the disposal of their used oil for human safety and protection of the environment. Unfortunately, the appropriate management of used oil is common problem for many African countries including Uganda. Used oil, like other wastes have negative environmental and human health risks because of inadequate systems for collection, storage, recycling, reuse, and disposal among others (Zitte et al, 2016). Besides air pollution and major oil spills, a prime environmental cost of oil consumption is improper disposal of waste oil (William et al, 1971). Like most African countries, Uganda is experiencing rapid industrialization process which increases dependency on oil. However, it can mitigate the harmful effects of fossil fuel use through better management practices. At the moment, information on used oil disposal practices in Uganda remain scanty. Therefore, it is not known how oil companies operating in Uganda handle and dispose of the used oil at the filling stations. This study seeks to generate knowledge which might be used to advance evidence-based monitoring as well as informing policy makers on key intervention areas for better practices.

METHODOLOGY

Study Area

This study was conducted within Makindye division which comprises Kansanga, Nsambya central, Kabalagala, Kibuli, Wabigato, Bukasa, Kisugu, Ggaba, Kibuye I, Kibuye II, Makindye I, Makindye II, Lukuli, Luwafu, Katwe I, Katwe II, Buziga and Salaama. From the Parishes listed above this study involved data collection at the garage and filling stations. Specific filling stations are Shell Kansanga, Shell Kabalagala, Shell Muyenga, Shell Clocktower, Total Nsambya, Total Kibuli, Total Ggaba, HassBunga, KobilKansanga, KobilKibuye, Oryx Bunga and Petro Kabalagala. Six types of filling stations visited were; 4 Shell, 3 Total, 1 Hass, 2 Kobil, 1 Oryx and 1 Petro.

Study Design

A structured interview with employees of each filling station was followed by observations to obtain the data. The interviews were done at work place (garage) of each filling station where used oil is removed from vehicles (cars, bus, trucks and motor cycles).

Sampling and Data Collection

All the 12 filling stations within Makindye division were included in the study, and respondents were selected at each filling station based on job assignment. The filling stations included in the study were selected based on accessibility by road and location within study area.

We gathered both qualitative and quantitative data during the study. Qualitative data collection approach consisted of a list of open-ended questions on perceptions, attitudes and experience of the respondents. The open-ended nature of the question made the interview more interactive as the researcher engaged the respondents more directly in probing certain topics in more detail. Interview focused on themes like experience, knowledge and management of used oil as well as disposal of used oil at a filling station. Non-participant observations were also done and data recorded. The observation data provided additional information which complemented the information gathered through interviews. Quantitative data collection focused on number of vehicles, frequency of used oil removal and volume of used oil produced at each filling station.

Data Analysis

Quantitative data analysis for descriptive measures such as frequency distribution, mean and percentages were done in excel and the analyzed data interpreted and presented in tables.

RESULTS

The major sources of used oil were; Engine oil and Gear box. Table 1 shows the filling stations in terms of the sources from vehicles (like cars, taxi, motorcycles, generator, trailers, and buses). Shell had of identifying both engine and gear box as sources of used oil, the rest of the filling stations either identified one or both. The table also shows that Hass, Oryx, Petro filling stations identified engine when was visited. Two (2) Total filling station identified engine while the other one identified both engine and gear box. One of the Kobil filling stations identified engine while the other gear box only.

According to the results 50% stated engine only, 8.33% stated gear box only and 41.67% stated both engine and gear box.

Table 1: Provides a Description of Used Oil Sources for Each Filling Station

Sources of Used Oil	Shell(4)	Total(3)	Hass(1)	Kobil(2)	Oryx(1)	Petro(1)	%
Engine	0	2	1	1	1	1	50.00
Gear box	0	0	0	1	0	0	8.33
Both (Engine &Gear box)	4	1	0	0	0	0	41.67

Identification of Used Oil Generated from Different Sources in Filling Stations (Generation of Used Oil).

As seen on the table below, used oil was identified based on its generation like cars, generators, Lorries, buses motorcycles and industries. The numbering in table shows the filling stations that identified used oil generated from different sources. For example, the station shell had number (4) in cars indicating all the 4 shell stations mentioned it while petro had number one (1).

Generation of used oil in cars were the highest of 40%, Generators (13.33%), lorries (16.67%), buses (6.67%), motorcycles (20%) and industries (3.33%)

Table 2. Identification of Used Oil generated from Different Sources in Filling Station

Generation of Used Oil	Shell(4)	Total(3)	Hass(1)	Kobil(2)	Oryx(1)	Petro(1)	%
Cars	4	3	1	2	1	1	40
Generators	2	1	0	0	0	1	13.33
Lorries	2	2	0	1	0	0	16.67
Buses	1	1	0	0	0	0	6.67
Motorcycles	2	2	0	0	1	1	20
Industries	0	0	0	1	0	0	3.33

Table 3 below shows safety handling of used oil at various filling stations. The used oil from diesel cars, petrol cars and hydraulics are either separated or not separated before being put in drums, tanks or other disposal safety areas. Kobil filling stations separate their used oil before it is disposed. Of the six filling stations, only Hass and Oryx did not separate their used oil at all before disposal to the drums and interceptors. In contrast, Total, Kobil and Petro filling stations completely separate their used oil in containers before disposal away from the point of generation. As for Shell, 3 of the 4 filling stations separate their used oil, which suggests that Shell management is not uniform across its various filling stations, especially in regard to handling of used oil prior to its disposal. Overall, 75% of all filling stations separate hydraulic oil, petrol and diesel before disposal, while the remaining 25% does combine different brands of used oil.

Table 3: Categorizing of used oil generated from different sources in filling station

Stations/ No	Shell(4)	Total(3)	Hass(1)	Kobil(2)	Oryx(1)	Petro(1)	%
Separation of used oil							
Yes	3	3	0	2	0	1	75
No	1	0	1	0	1	0	25

Oryx had the least percentage (3%), as seen on the table below because there were only 3 cars that removed used oil daily in the station. Most of the cars did their services in the filling station which were close by. Hass (5%) had 6 vehicles that removed oil per day. Kobil (23.7%) had 25 vehicles that removed oil per day. Petro (6.16%) had 6.5 vehicles that removed oil per day.

Shell (41%) had more customers daily with the highest percentage due to the services and brand.

The used oil removed from vehicles weekly, Hass had the least percentage of 2.19 with 10 vehicles while Shell had 31.91 with 145.5 vehicles, the highest percentage of used oil removed per week. All the filling station with the exception of Hass, Oryx and Petro which was visited once, while the others like shell had four (4) filling stations in the study, total (3) and Kobil (2) also helped in increasing the percentages. Total had 27.19 % with 124 vehicles that removed oil per week. Kobil had 30.7% with 140 vehicles. Oryx had 2.74% with 12.5 vehicles that removed oil per week. Petro had 5.26% with 24 vehicles that removed oil per week.

Table 4: Vehicles that Came to the Filling Stations for Removal of Used Oil

Filling Station	Daily collection of used oil		Weekly collection of Used oil	
	Vehicles	%	Vehicles	%
Shell	43	40.76	146	31.91
Total	22	20.85	124	27.19
Hass	6	5.69	10	2.19
Kobil	25	23.7	140	30.7
Oryx	3	2.84	12.5	2.74
Petro	7	6.16	24	5.26

Three filling stations accounted for 83% volume of used oil collected at all the six filling stations which participated in this study. On average, three most busy filling stations had 27.7% of used oil production each. In contrast, three less productive filling stations had an average of 5.6% of used oil each. The three filling stations with very low amount of used oil collection included Oryx, Petro and Hass. On a low production side, Oryx had 8.38 percent with 6.54% of used oil in liters. Following the down trend was Petro at 6.54% with 12.5litres of used oil produced. Hass had the lowest percentage of 2.09 with 4 liters used oil during the study.

As for weekly, Total had the highest percentage of 37.32% and Oryx had the lowest percentage of 2.56% of used oil produced weekly. Hass had the percentage of 8.13 with 175 liters of used oil produced weekly. Petro had 9.3% with 200litres of used oil produced weekly. Shell had 19.75% with 425litres of used oil produced weekly.

Table 5: Used Oil Production at Different Filling Stations in Makindye Division

		Daily Used oil production		Weekly Used oil Production	
Filling	Stations (n)	Litres	%	Litres	%
Shell	4	39.5	20.68	425	19.75
Total	3	81	42.41	803	37.32
Hass	1	4	2.09	175	8.13
Kobil	2	38	19.9	493.5	22.9
Oryx	1	16	8.38	55	2.56
Petro	1	12.5	6.54	200	9.3

Storage and Disposal of Used oil at a Filling Station

Table 6 shows the number of filling stations involved in the storing of used oil. Used oil was stored in the following places before disposal; Interceptor, tank, drums, Jerri cans, and cans. Three (3) of the filling stations stored their used oil before disposal in the interceptor with 14.29%, four (4) of the filling stations stored theirs in the tank with 33.33%, four (4) stored in drums with 33.33%, two (2) in Jerri cans with 14.29% and one (1) in cans with 4.76%.

Table 6: Storage of Used Oil before Disposal

Filling Stations (n|)	Shell (4)	Total (3)	Hass (1)	Kobil (2)	Oryx (1)	Petro (1)	%
Storage of used oil							
Interceptor	1	1	0	0	1	0	14.29
Tank	1	3	1	2	0	0	33.33
Drums	3	0	1	2	1	0	33.33
Jerri cans	2	0	0	1	0	0	14.29
Cans	0	0	0	0	0	1	4.76

According to the result, only Hass filling station disposed their used oil daily. Weekly, only Oryx filling station disposed their used oil. One of Shell filling station, one of Kobil filling station, and Petro filling station disposed their used oil twice a week. Two of Shell filling station and one of Total filling station disposed their used oil every fortnight. One of Shell filling station, one of Total filling station disposed their used oil monthly. One of Total filling station and one of Kobil filling station disposed their used oil monthly+.

Table 7: Frequency of Used Oil Disposal at Various Filling Stations

Filling Stations	Shell (4)	Total (3)	Hass (1)	Kobil (2)	Oryx (1)	Petro (1)	%
Used oil disposal frequency							
Daily	0	0	1	0	0	0	9.09
Weekly	0	0	0	0	1	0	9.09
Twice a week	1	0	0	1	0	1	27.27
Fortnight	2	1	0	0	0	0	18.18
Monthly	1	1	0	0	0	0	18.18
Monthly +	0	1	0	1	0	0	18.18

DISCUSSIONS

From our findings, used oil is classified into two categories in all filling stations that participate in the study. On the contrary other studies showed more than two classification of used oil. For example, a study by Yu et al (2012) listed sources and classification of used oil as; Used lubricating oil, chain saw oil, hydraulic fluid, lubricating grease. Other classifications include oil sand derived from crude oil and liquefied petroleum gas mining, used oil derived from the process of refined petroleum manufacturing, used oil derived from ship build industry, oil-

contained waste water (used oil), used oil derived from ink production, used oil derived from coating production.

Used oil is identified based on its source of generation like cars, generators, lorries, buses motorcycles and industries (Boughton et al, 2003). From the sources we have listed, it is clear that used oil is generated from a broad variety of sources within the transportation, construction, and industrial sectors and consists of lubricating oils (motor and transmission oils) and industrial oils (hydraulic and cutting oils).

In all filling stations there was no clear used oil management department/section or plan. This suggests that environmental monitoring, policy and inspection are issues which are not currently being addressed in regard to used oil collection, storage and disposal. These are issues which the Ministry of Transport and the Ministry of Energy and Mineral Development may need to address urgently as part of any attempts to clean the transport sector and manufacturing industries in Uganda. The two sectors are particularly important in ensuring proper management of used oil, because our findings show that the transport sector and industries contributed the largest share of all sources of used oil.

Uganda like many African countries, lacks legally instituted used oil recycling company. The fossil fuel industry is at the moment characterized by small scale, low technology and isolated fuel companies like Kobil, Hass, Petro City, Oryx, Starbex and many others. In the context of a global agitation for transition to green economy, the government of Uganda may need to issue recycling obligation for all filling stations, as well as industries that are legally operational in the country. As Yu et al (2012) explains, a proper management of used oil could lead to the realization of reduced environmental pollution while, at the same time, providing a remedy to local industries for shortage of oil resources.

Uganda like many African countries lag behind developed world in used (waste) oil regeneration. Evidence from the work of Irwin and Burhenne (1971) reveal that Germany began encouraging the regeneration of waste oil more than half a century ago by providing governmental subsidies. It reduced national expenditures for importing raw materials and assured the existence of waste oil regenerating businesses. Then in 1953 Germany switched from a direct subsidy to a tax preference whereby tax on reprocessed oil reduced by 15 Deutsche Mark (DM) ($3.75) for each 100 kilograms of regenerated oil. A decade later (1964) the Council of the European Economic Community (EEC) decided to harmonize their provisions governing the collection and harmless disposal of waste oil (Irwin and Burhenne, 1971). The EEC then discovered that France and Italy were already giving tax preferences, as Germany had done. The need to alleviate fuel shortage due to crises in the Middle East prompted France's preference tax policy aimed at protecting regenerating firms as an incentive, whereas Italy was of the view that it was unfair to tax regeneration of waste oil, since oil is taxed in the first instance of production (Irwin and Burhenne, 1971).

Thus, Uganda should impose legal conditions for fuel companies to reprocess waste oil, or give them for free to other companies which can invest on reprocessing equipment for oil regeneration. This will assure environmental and public health safety, besides other economic benefits like creation of new businesses.

CONCLUSION

All the filling stations identified the major sources of used oil as vehicle engines and gear boxes. The used oil was categorized or separated as diesel used oil and petrol used oil, at a filling station level. Some two of the filling stations separated their used oil while others mixed them up or partially separate used oil. Shell, Total and Kobil filling stations were the most popular for removal and storing used oil from vehicles. Variations in volume of used oil removed at a filling station level occur between filling stations. Similarly, disposal also varies depending on the demand for used oil by customers; mainly industries and individuals who purchase used oil for their own use as wood preservatives.

Most filling stations store the used oil from vehicles in tanks, drums, interceptors, cans, and Jerri cans. In some instances, the used oil was sold to clients at a filling station, but in most cases the company head management office collects used oil from their respective filling stations on a regular basis. The destination of used oil once it leaves the filling stations was not very clear, and the respondents themselves did not have any knowledge of its way about once it leaves the filling station. A lot of precautions need to be taken since improper disposal of used oil can cause environmental problems to land, water and air. For instance, soil micro-organisms have limited ability to decompose many kinds of oils, which implies that soil value for crop cultivation may be compromised if great care is not take in disposing used oil. Poorly disposed oil can also contaminate surface waters as well as filtering into underground aquifers thereby spoiling underground water completely. A policy is needed on proper used oil incineration and regeneration processes in order to avoid negative effects on environment and public health.

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Conflict of Interest

The authors declare that they do not have any conflict of interest

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