IJSES
International Journal of Scientific Engineering and Science
Volume 5, Issue 11, pp. 48-55, 2021. ISSN (Online): 2456-7361

Prospect of Domestic Wastewater Usage in Udung Uko Lga in Akwa-Ibom: Household User Perceptions

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Abstract— *This study assesses the possibility of reuse of wastewater and its acceptance from households in Udung Uko LGA in Akwa-ibom. The study set out to identify the major source of water, the household activities that can accommodate the use of wastewater, the activities with the highest water demand and the respondent's acceptance of the reuse of wastewater within the study area. It was pursued using a structured questionnaire administered to 200 household respondents with only 172 returned adequately filled giving a percentage response of 86%. The data gotten where analyzed using SPSS version 16.0. The result revealed among others that; Tap water and borehole water identified as the major water source within the area of study, washing is the household activities that requires the highest amount of water supply, consequently the reason why the bathroom is the highest point of generation of wastewater within the household. Also, Reduction in the demand and stress on fresh water supply as the major advantage of the wastewater reuse in household activities within the study area. Finally, it reveals the respondent's acceptance of the use of wastewater for some house hold activities. Consequently, Public enlightenment on treatment of wastewater should be made, to educate them so as to change their mind sets about wastewater, to stop seeing it as waste and a burden, but rather as a resource*

Keyword— *Domestic wastewater, Reuse, Household activities.*

I. INTRODUCTION

In the face of population growth and increasing demand for water, rapid development of increasing environmental degradation needs to critically assess options for long – term security of water supply in Udung Uko LGA in Akwa-ibom is very vital. In line with facility management, wastewater management is one of the eleven core competencies (human and environmental factors), therefore, can be managed by either in house or outsourcing, depending on the stakeholders, that is, the managers and end users

Wastewater can be defined as that which is purely domestic in origin or it contains some industrial or agricultural wastewater as well (UNESCO, 2012). In this research work, wastewater is referred to the one that is domestic (wastewater), called "gray water" or "sulluge" which is the wastewater from personal washing, laundry, food preparation and the cleaning of kitchen utensils as well as bathing. Gray water can be collected, given on-site partial treatment and use for secondary purposes like we flushing (Mbamali et al., 2007).

The main sources of water in the study area are tap water, borehole water and well water. Water scarcity can lead to poor sanitary conditions and exposure to health risk.

Water supply in Udung Uko LGA in Akwa-ibom for the past 10 years has been epileptic, which has made some households using wastewater for other non-potable uses/needs. Its use would reduce the volumes of wastewater being disposed of to the environment and it could reduce the demand for fresh water suppliers Wastewater is recognized as an important water resource that could be used more extensively in areas where there are challenges of water (KSMWR, 2006). Reusing wastewater is beneficial in that it aids in conserving water. In many locations of the metropolis where the supply of fresh water has become in adequate to meet water needs, some households use wastewater as a resource. In most societies, the focus on water's special status tends to obscure the fact that, only a tiny fraction of water consumption is actually for drinking and preserving life (TNA, 2004). A large portion of urban water is use for convenience and comfort. The value to particular user depends crucially on its location, quality and availability (WHO 1990). Water location, determines its accessibility and cost.

There have been inadequate or insufficient water supply in Udung Uko LGA in Akwa-ibom must especially in the dry season. This has resulted that some inhabitants of the study area are now using the wastewater (untreated) in other areas to reduce the hardship being faced in search for clean/pure water. This problem of using raw wastewater as a resource to supplement the demand on clean water has raised the concern of the researcher, hence the study sought to establish the sources of household water, the attitudes of habitants towards water usage, the sources of wastewater from the household and the impact of wastewater usages over fresh water supply in the household.

This considered very important because these situations pose great danger to the health of the inhabitants and adversely affect their economy. Reuse of wastewater have been observed to reduce reasonable amount of domestic water demand which is believed could improve the water requirement of the household; hence the need for the study. Thus, this research work is aim at assessing the perceptions of household on wastewater reuse in Udung Uko LGA in Akwa-ibom with a view to encourage the use of it. The study covered only Udung Uko LGA in Akwa-ibom, that is, Edikor, Ekim and part of Uboro Isong Inyang.

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II. Literature Review

Water Scarcity

Water scarcity already affects every continent. By 2025, 1.8 million people will be living in countries or regions with absolute water scarcity, and two – thirds of the world's population could be living under water stressed conditions into loss of access to water for the poor and other vulnerable groups (UN, 2012).

Water is a scarce resource affecting many aspects of the nation's developmental programmes and natural environment. It is a key resource in any plan for implementing a sustainable development (WWC, 2003). It was reported that, with the global population increasing and climate changing, many communities are facing water supply challenges, as a result, water reuse is attracting increasing attention (NAS, 2012).

Household wastewater/sulluge

Sulluge, also known as grey water is domestic wastewater not containing excreta – the discarded from baths, sinks, basins and the like that may be expected to contain considerably fewer pathogenic microorganisms than sewage (Richard, 1983).

Gray water is wastewater collected from washing machines, showers, bathroom sinks and any other building water systems that do not require extensive chemical or biological treatment before being reused (Odeh, 2003). If properly collected, stored and filtered, grey water can safely be reused for non – potable purposes such as irrigation or toilet flushing, helping to reduce a building water consumption (Yale, 2012).

Quantity of wastewater discharge

Sulluge volumes depend upon domestic water use. Where people use public taps, daily domestic water use may be as low as 10 litres per capita. In effluent households with full plumbing, daily water use may be 200 or more litres per capita, and all water not used for flushing toilets may be chassed as sulluge (Richard, 1983).

Composition of wastewater

Wastewater may be purely domestic in origin or it may contain some industrial or agricultural wastewater as well. In considering only domestic wastewater and most especially the one call "Sulluge" which is the wastewater from personal washing, laundry, food preparation and the cleaning of kitchen utensils as well as bathing. It is grey turbid liquid which has an earthy but offensive odour. It is contains large and small floating or suspended solids. It is objectionable in appearance and extremely hazardous in content, mainly because of the number of disease – causing (pathogenic) organisms it contains (Duncan, 1978). Fig. 1 shows the composition of wastewater.

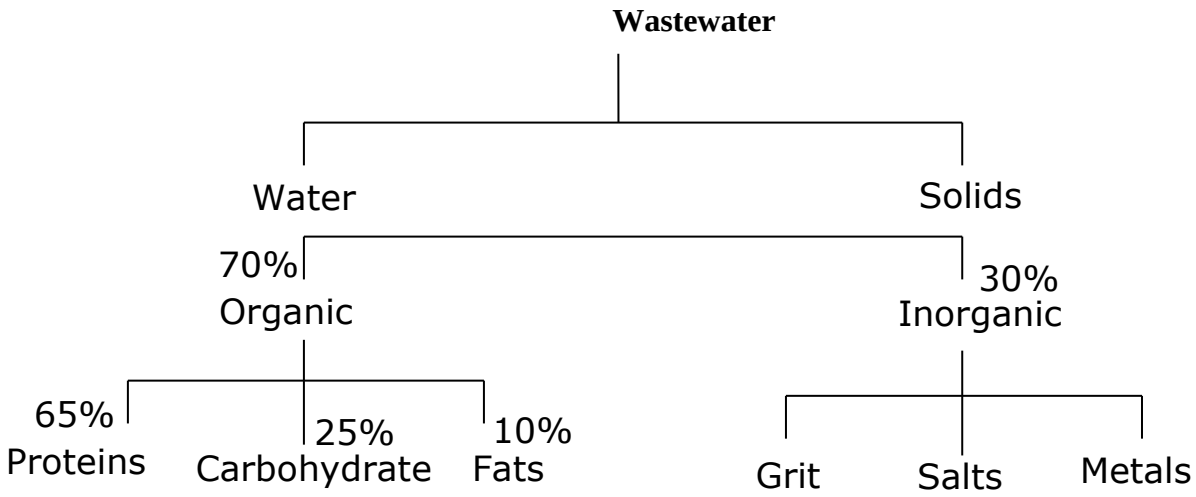

Fig. 1. Composition of wastewater [Source: Tebbutt, 1970].

Composition of household wastewater

Richard (1983) also found out that, the result of surveys of five households in the United States is shown in Table 2.2. The Sulluge contributed 53 percent of the sewage flow, 52% of the BODs, 43% of the chemical oxygen demand, about 15% of the nitrogen, and 45% of the phosphates. It further indicates that, if the ration of chemical oxygen demand to BODs is used as the cniterion, toilet wastes are more resistant to biodegradation than sulluge.

Wastewater as a Resource

Wastewater as valuable resources can reduce demands on already scares resources. UN (1958) stated that, no higher quality water unless there is a surplus of it, should be used for a purpose that can tolerate a lower grade. Low quality waters such as wastewater drainage waters and brackish waters should, whenever possible, is considered as alternative sources for less restrictive uses. Furthermore, water is a renewable resource within the hydrological cycles. Once used, however, water can be reclaimed and used again for different beneficial uses.

The quality of the once – used water and the specific type of reuse (or reuse objective) define the levels of subsequent treatment needed (WHO/UNEP, 1997). Toilet water for instance, is rich in organic material, if the concentration of this so – called black water is high enough, you can crate energy out of this organic material, you can also turn it into compost and fertilizers (IPS, 2009).

III. Methodology

The study investigated the acceptability of wastewater reuse from households in Udung Uko LGA in Akwa-ibom. Udung Uko local government area is found in Akwa Ibom state, South-south geopolitical zone of Nigeria. The LGA is bordered by the Oron, Okobo, Urue Offong, Oruku, and Mbo. Towns and villages that constitute Udung Uko LGA include Uboding, Okpo, Afaha Okpo, Uboro Isong Inyang, Enino, Eyo Ating Osung, and Eyiba. The estimated population of Udung Uko LGA is put at 169,084 inhabitants with the area primarily inhabited by members of the Oron ethnic division. The Oron language is widely spoken in the LGA while the religions of Christianity and tradtionalism are commonly practiced in the area.

This was conducted through the administration of well-structured questionnaire. The pivot around which this study rotates is the research questions earlier postulated. In attempt to answer these questions, theoretical designs which include survey, analysis of results, interpretations of ideas etc to deal with various sociological and psychological variables, all which combined to classify this study as a survey design.

The researcher therefore, selected some subjects of Udung Uko LGA in Akwa-ibom through the use of stratified random sampling. The approach also utilizes the help of tools like questionnaires and interview.

Sampling Technique and Size

The population of Udung Uko LGA in Akwa-ibom is high density of about 1.5 million with household population of 314,066 according to census 2006 (FRN, 2009; NPC, 1998; average of 5 per household of 1991 census), (Stanley, 2009), out of which 140 households were taken as sample.

The research used random sampling method or technique in the selection of the respondents by dividing Udung Uko LGA in Akwa-ibom into four areas, based on the four communities in the Local |Government Area, that is, Edikor, Ekim, Uboro Isong Inyang and Udung Uko Eyoatai communities respectively, in which were given questionnaires to be filled or interviewed using the same questionnaire.

TABLE 3.1 Sample size

Local government area	Sample
Edikor	50
Ekim	50
Chikun	50
Udung Uko Eyoatai	50
Total	**200**

Source: Field Survey, 2018

The sample population of 140 adults (households) were utilized out of the total population of about 1.5 million of the information needed for this research study area obtain.

Data Collection Instrument

Primary data

The primary data were collected through the use of structured questionnaire in which the respondents were free to express their opinions on the same questions on the spaces provided on the questionnaire as shown in the appendix.

Administration of data collection

The questionnaires were administered to those who could read and write, were collected back after or later by the researcher when it was filled. For those respondents that could not read or write well, they were interviewed by the researcher using the same questionnaire.

Method of data analysis

Data for this study will be processed and analysed with the aid of the Statistical Package for Social Science (SPSS 20), the calculations will be done using descriptive statistics (e.g frequency distribution tables, percentages, and mean item score). Also, random sampling and Relative Importance Index (RII) will be used for analyzing data collected and variables were measured on a five-point Linker-scale scored as follows:1=strongly disagree,2=disagree,3=Indecisive, 4=agree and 5=strongly agree. The data analysis must answer the research questions and satisfy the research objectives. The results will therefore be represented in tables. statistical methods made use of are descriptive methods (e.g., frequency distribution tables and percentages) and the result is presented in tables.

While research questions two, three, and four were analysed using the relative importance index (RII), adopting the five (5) point Linker's scale. The data analysis, therefore, employed the following steps:

a. Computation of the mean using the formula

Mean (m) = $\Sigma FX / \Sigma F$

Where;

x = points on the Linker's scale (1, 2, 3, 4, and 5)

f = frequency of respondents' choice of each point on the scale

b. Computation of the relative importance index (RII) for each item of interest, using the formula RII = m / 5(highest linker scale)

c. Ranking of the items under consideration based on their RII values. The item with the highest RII value is ranked first (1) the next (2) and so on.

d. Interpretation of the RII values as follows:

RII < 0.60, the item is assessed to have a low rating

$0.60 \leq$ RII <0.80, item assessed to have a high rating.

RII $\geq$ 0.80, item assessed to have a very high rating

IV. Data Presentation, Analyses and Discussion

Data Presentation and Analyses

Questionnaire Distribution

Table 1 presents the percentage response of the questionnaire distribution. From the Table, a total of two hundred questionnaires were distributed with a total of one hundred and seventy-two returned adequately filled giving a percentage response of 86.0%. details are as presented in the Table.

TABLE 1. Questionnaire Distribution

Questionnaire distribution	Frequency	Percentage (%)
Returned	172	86.0
Not returned	28	14.0
Total	**200**	**100**

Source: Field Survey, 2018

International Journal of Scientific Engineering and Science
Volume 5, Issue 11, pp. 48-55, 2021. ISSN (Online): 2456-7361

Respondents Profile

Table 2 show the result of the analysis of the respondent's profile. From the Table it can be established that a larger percentage of the respondents 69.3% were female while the male respondents were 30.7%. the result also shows that a larger percentage of the respondents 51.2% have also lived within the area of study within the years bracket of 21-30years.this was followed closely 23.3% of the respondents who claim to have lived in the area for over thirty year, an indication that the respondents are knowledgeable of the water challenge in the area. Also, from the Table it can be seen that a larger percentage of the respondents 45.8% had Bachelor's degree as their highest qualification, followed closely by 39.0% that had Higher National Diploma (HND) as their highest qualification. Details are as presented in the Table.

TABLE 2. Respondents Profile

S/N	Variable	Option	Frequency (No)	Percentage (%)
1	Gender:	a) Male	53	30.7
		b) Female	119	69.3
		Total	**172**	**100**
3	Respondents' duration of staying in the area	a) 1-10years	17	9.8
		b) 11-20years	27	15.7
		c) 21-30years	88	51.2
		d) > 30years	40	23.3
		Total	**172**	**100**
4	Highest Qualification	a) Ordinary National Diploma (OND)	13	7.6
		b) Higher National Diploma (HND)	67	39.0
		c) Bachelor's Degree	79	45.8
		d) Masters	13	7.6
		e) Doctorate Degree	-	-
		Total	**172**	**100**

Source: Field Survey, 2018

TABLE 3. Sources of Water, average quantity of water used per household, and how water is sourced

S/N	Variable	Option	Frequency (No)	Percentage (%)
1	Water source	a) Tap Water	82	47.7
		b) Borehole	78	45.3
		c) Well	-	-
		d) River	12	7.0
		Total	**172**	**100**
2	Daily quantity of water use	a) 50-100 litres	88	51.2
		b) 101- 250litres	40	23.3
		c) 251- 1000litres	44	25.5
		d) Above 1000litres	-	-
		Total	**172**	**100**
3	Payment of water	a) Yes	67	39.0
		b) No	105	61.0
		Total	**172**	**100**

Source: Field Survey, (2018)

Sources of Water, average quantity of water used per household, and how water is sources

Table 3 shows that many households 47.7% have their source of clean water from tap water while 45.3% of the respondents claim that their major source of water is Boreholes with only 7.0% claiming their major source as rivers. The average quantity of water used by household was also assessed and the result revealed that a larger percentage of the respondent 51.2% use an average of 50-100liters of water daily. However, 25.5 % claim to use an average of 251-1000liters while 23.3% use an average 101-250liter. With regards to paying for water a larger percentage 61.0% claim that they do not pay any water bills. Details are as provided in the table.

Highest household activities requiring water supply, knowledge of Wastewater reuse and source of wastewater in the household

The paper also sought to identify the household activities with highest water demand and the result is as presented in Table 4. From the Table Washing 47.7% was rated the highest household activity with water demand. This was closely followed by cooking 24.4%, Cleaning 16.3% and Gardening 11.6% arranged in their order of severity. The Table also presented the major source of wastewater in the household and from the result, it can be seen that the bathroom 60.5%, kitchen 27.9% and others 11.6% are the major sources of waste water arranged in their order of severity. Finally, from the Table it can be seen that 73.3% of the respondents claim to be knowledgeable of waster reuse in the household.

Activities that allow the use of recycled water in households and ranking of the benefit of water reuse.

From Table 5, 86.4% of the respondents attested to the possibility of recycling water in the household. Also, Toilet flushing was identified as the highest activity that can be done in the household that can be done using recycled water (57.0%). Details of other activities in the household that can easily be carried out with recycled water are; gardening 27.9%, cleaning 9.3% while 5.8% claim that there is no activity that can be carried out in the household with recycled water. Finally, a large

percentage 72.1% of the respondents claim that there are benefits of recycling water in household.

TABLE 4. Highest household activities requiring water supply, knowledge of Wastewater reuse and source of wastewater in the household

S/N	Variable	Option	Frequency (No)	Percentage (%)
1	Household activity	a) Cooking and consumption	42	24.4
		b) Washing	82	47.7
		c) Cleaning	28	16.3
		d) Gardening	20	11.6
		Total	**172**	**100**
2	Major sources of wastewater	a) Kitchen	48	27.9
		b) Bathroom	104	60.5
		c) others	20	11.6
		Total	**172**	**100**
3	Knowledge of Wastewater Reuse	a) Yes	127	73.8
		b) No	45	26.2
		Total	**172**	**100**

Source: Field Survey, (2018)

TABLE 5. Activities that recycled water in households and benefit of water reuse.

S/N	Variable	Option	Frequency (No)	Percentage (%)
1	Possibility of recycling water in Households	a) Yes	149	86.4
		b) No	23	13.6
		Total	**172**	**100**
2	Activities that be done using recycled water in households	a) Cleaning	16	9.3
		b) Toilet (flushing	98	57.0
		c) Gardening	48	27.9
		d) None	10	5.8
		Total	**172**	**100**
3	Are there benefits of recycling water in households	a) Yes	124	72.1
		b) No	48	27.9
		Total	**172**	**100**

Source: Field Survey, (2018)

TABLE 6. Respondent Opinion on the benefits Wastewater reuse

S/N	Benefits of water reuse in Households	Frequency Percentage					∑F	∑Fx	Mean	RII	Rank
		1	2	3	4	5					
1	Avoiding expensive non-compliance fees	-	14	14	71	73	172	719	4.18	0.84	4th
2	Improving sustainability	-	14	14	58	86	172	732	4.25	0.85	3rd
3	Water saving	-	14	14	100	48	172	685	4.01	0.82	6th
4	Reduce demands and stress on freshwater supply	-	-	-	99	73	172	761	4.43	0.89	1st
5	Reducing environmental impact	-	-	-	104	68	172	756	4.39	0.88	2nd
6	Cost saving	-	-	16	113	43	172	716	4.16	0.83	5th

Source: survey, 2018
Where 1-strongly disagree, 2-disagree, 3-indecisive, 4-agree, 5-strongly agree

From Table 6, it was established that the highest benefits of water reuse in households as ranked by the respondent was Reduce demands and stress on freshwater supply with relative importance index RII of 0.89, which was closely followed by Reducing environmental impact with RII of 0.88, and Improving sustainability with RII of 0.85 ranked second and third respectively. others are therefore ranked with their degree of importance as follows; Avoiding expensive non-compliance fees with RII of 0.84, Cost saving with RII of 0.83, Water saving with RII of 0.82.

Household waste water Collection, treatment, and benefit of treatment of waste water.

Table 7 presents Household waste water Collection method, treatment, and benefit of treatment of waste water. The Table shows that a large percentage of the respondents (51.2%) claim that waste water is easier collected in bathroom/jerrycans while 36.1 % claim wastewater are best collected in Kitchen/basic in the household. The Table also shows that 72.1% of the respondents attested to the fact that the wastewater is not treated before reuse. With regards to the respondent's opinion on the advantage of treatment of the wastewater before reuse; 56.4% attested to the fact that it leads to water conservation, 26.2% claims it leads to cost savings. Details are as provided in the table.

Reasons for using of wastewater

Table 8 shows Reasons for using of wastewater. It can be seen that the respondents ranked Augment primary water resources with an RII of 0.91 first or highest reason. This was closely followed by Avoidance of environmental with an RII of 0.90 (2nd) and minimize infrastructural cost with RII of 0.88 (3rd). details of the ranking of other reason for water reuse are as presented in the Table.

International Journal of Scientific Engineering and Science
Volume 5, Issue 11, pp. 48-55, 2021. ISSN (Online): 2456-7361

TABLE 7. Household waste water Collection, treatment, and benefit of treatment of waste water.

S/N	Variable	Option	Frequency (No)	Percentage (%)
1	Wastewater Collection	a) Bathroom/Jerry cans	88	51.2
		b) Others/Collection tank	22	12.7
		c) Kitchen/Basins	62	36.1
		Total	**172**	**100**
2	Method of wastewater treatment	a) Adding of chemicals	48	27.9
		b) Not at all	124	72.1
		Total	**172**	**100**
3	Advantages of treating and using wastewater	a) Water conservation	97	56.4
		b) Cost saving	45	26.2
		c) Avoid diseases	13	7.6
		d) Avoid diseases & conserve water	17	9.8
		Total	**172**	**100**
4	Wastewater Disposal point in the household	a) Septic Tank	**79**	**45.8**
		b) Central sewer system	**8**	**4.7**
		c) Pit Latrine	**24**	**14.0**
		d) Throwaway	**16**	**9.3**
		e) Gardening	**45**	**26.2**
		Total	**172**	**100**

Source: Field Survey, (2018)

TABLE 8. Respondent Opinion on the Reasons for using of wastewater

S/N	Reasons for using of wastewater	Frequency Percentage					∑F	∑Fx	Mean	RII	Rank
		1	2	3	4	5					
1	Avoidance of environmental	-	-	14	58	100	172	774	4.50	0.90	2nd
2	Reduction of discharges of wastewater	-	-	28	58	86	172	746	4.34	0.89	4th
3	Augment primary water resources	-	-	-	82	90	172	778	4.53	0.91	1st
4	Minimize infrastructural cost	-	-	28	44	99	172	760	4.42	0.88	3rd

Source: survey, 2018
Where 1-strongly disagree, 2-disagree, 3-indecisive, 4-agree, 5-strongly agree

TABLE 9. Type of wastewater prefer to use and impact of wastewater reuse on fresh water supply

S/N	Variable	Option	Frequency (No)	Percentage (%)
1	Acceptance of Reuse wastewater in household	c) Yes	126	73.3
		d) No	46	26.7
		Total	**172**	**100**
2	Type of wastewater prefer to use	a) Gray water (kitchen & bathroom)	138	80.2
		b) Foul water (toilet flushing)	8	4.7
		c) Grey & foul water	8	4.7
		d) Not at all	18	10.4
		Total	**172**	**100**
3	Impact of wastewater reuse on fresh water supply	a) Water saving	124	72.1
		b) Cost saving	28	16.2
		c) Cost & water saving	12	7.0
		d) Not at all	8	4.7
		Total	**172**	**100**

Source: Field Survey, (2018)

Preference in wastewater usage and impact on fresh water supply.

Table 9 shows that a large percentage of the respondent 73.3% express total acceptance to the reuse of wastewater for some household activities. In view of this, 80.2% expressed preference to the use gray water (kitchen and bathroom) wastewater as a type of wastewater over other type of waste water such as foul water (toilet flushing). Finally with regards to the impact of wastewater reuse on the fresh water supply 72.1% attested to the fact that it leads to water saving thereby helping out to handle menace of water scarcity in the area.

V. SUMMARY

From the ongoing the following can be established from the study

Tap water and borehole water identified as the major water source within the area of study. Inline with this the study identified that a large percentage of the respondents within the study area have a daily quantity of water use to be between 50-100liters and 101-250lteres depending on the family size

The study also revealed that washing is the household activities that requires the highest amount of water supply. Inline with this the study further reveal that the bathroom is the part of the household with highest possibility of getting reusable wastewater in the household. While toilet (flushing) is identified as the household activity that can easy be using recycled water/wastewater within the household

The respondent also identified reduction in the demand and stress on fresh water supply as the major advantage of the wastewater reuse in household activities within the study area.

With regards to the major reason for reuse of wastewater, the study identified augmentation of fresh primary water resources as the highest ranked reason. Thus, the study shows that, greater percentage of the respondents accepted to use wastewater in their households except for cooking and drinking as shown in Table 9 and as reported by UNESCO (2012), that wastewater can be reused as a source of water for multitude of water demanding activities, such as agriculture, aquifer recharge, parks and golf course watering, recreational impoundments, and essentially for several other non – potable requirements.

VI. Conclusion

The study sought to establish respondent's perceptions or opinions and acceptability of wastewater reuse in the area under study. The findings revealed that: -

i. Tap water and borehole water identified as the major water source within the area of study, thus a pressing need to augment this primary source of water for sustainability.
ii. washing is the household activities that requires the highest amount of water supply, consequently the reason why the bathroom is the highest point of generation of wastewater within the household.
iii. Toilet (flushing) is identified as the household activity that can easy be using recycled water/wastewater within the household
iv. Reduction in the demand and stress on fresh water supply as the major advantage of the wastewater reuse in household activities within the study area
v. With regards to the major reason for reuse of wastewater, the study identified augmentation of fresh primary water resources as the highest ranked reason
vi. The benefits of wastewater use are reduction in searching for water, save time, money etc.

VII. Recommendation

In order to encourage the reuse of wastewater as resource and for water conservation or saving. The following are therefore, suggested.

(a) Public enlightenment on treatment of wastewater should be made, to educate them so as to change their mind sets about wastewater, to stop seeing it as waste and a burden, but rather as a resource.
(b) Wastewater reuse options should be integrated in the planning for the municipal water supply in order to generate benefits to study area.
(c) Plan should be put in place to focus on accepting cultural norms of the people and appropriate regulations regarding the reuse of wastewater.
(d) Public Involvement through ENGO's (Environmental Non-Governmental Organizations) and residence associations will go a long way towards achieving wastewater reuse sustainability.

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