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Utilization of Colour-Coded Bins for Management of Solid Waste among Households in Obio Akpor Local Government Area, Rivers State

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Abstract

General objective of the study was to investigate issues relating to utilization of colour-coded bins for management of household solid wasted in Obio Akpor Local Government Area Rivers State. Specifically, the study determined: level of awareness of use of color-coded bins in HSW among households in area of study; level of utilization of colour-coded bins by the households; perceived benefits of use of colour-coded bins among the households; challenges households face in the use of color-coded bins and ways of enhancing the use of colour-coded bins by the households. This study employed survey research design. Population was made up of households in Obio/Akpor LGA. Data was collected with questionnaire. Data were analyzed using mean, frequency, percentages and standard deviation. Results of the study show show awareness levels for five indicators range from 71.92 to 17.85 percent; two colours of bins that are always used are blue (91.86%) and green for organic waste (80.5%); nine benefits of use of coloured bins ($\overline{X}$ = 3.02 -2.53); 10 challenges ($\overline{X}$ = 3.23 -2.53) household face in the use of the bins; and nine ways of enhancing utilization ($\overline{X}$ = 3.27 -2.79). based on the findings three recommendations were made.

Keywords: Household, Solid, Waste, Management, Coloured-coded, Bins, Utilization, Awareness, Benefits, Challenges.

Introduction

Household solid waste management encompasses a spectrum of activities, including supervision, gathering, conveyance, processing, recycling, and disposal (Omer, 2021). Solid waste management has emerged as a crucial concern on a global scale, especially in urban areas where garbage production has surged due to fast industrialization and population expansion. Sustaining the environment, advancing sustainable development, and preserving public health all depend on efficient waste management techniques. Color-coded bins are one cutting-edge method that has become popular all over the world for garbage segregation. Using specific colors, this technique divides waste into different categories, such as organic, recyclable, and general waste, to make sorting and identification easier. Successful implementation of such systems has led to notable gains in recycling rates and waste management efficiency in countries such as Germany, Sweden, and Japan (Sahoo *et al*.,2022).

If household refuse is not appropriately gathered, sorted, and processed, as is frequently the case in countries with limited technical efficiencies, it can result in not only the

hazardous elements but also all refuse having the potential to become unsafe, leading to long-term and cumulative environmental and human health consequences (Gutberlet & Uddin, 2017). The well-being of households, particularly in economically disadvantaged households, is not only impacted by the accumulation of uncollected refuse (Uddin *et al*., 2016) but can also be jeopardized by waste management installations, which may encompass landfills, dumps, and incineration facilities (Gutberlet, 2011). To effectively tackle the environmental, economic, and social repercussions of mismanaged household solid waste, innovative strategies are imperative. Among these, the deployment of colour-coded bins offers a systematic and practical approach to address this challenge. Color-coded waste bins are containers assigned a particular colour corresponding to a specific type of waste (Deva *et al*., 2019). These colours adhere to a standardization making them readily identifiable universally. When members of a household correctly employ these waste bins, it will significantly facilitate waste handling, categorization, and recycling processes. Colour-coded bins offer a promising avenue for addressing this challenge by categorizing waste into distinct streams - recyclables, organics, hazardous materials, and non-recyclables. This categorization aims to transform the way households interact with their waste, potentially resulting in higher recycling rates, reduced contamination, and increased public engagement in responsible waste disposal within their homes.

In many developing countries, including Nigeria, household solid waste management predominantly relies on open dumping due to its lower cost compared to other disposal methods (Nwosu & Chukwueloka, 2020). However, this non-sanitary and non-engineered approach lacks essential features like liners, gas and leachate collection, leading to multiple environmental pollution issues involving air, water, and soil (Fadhullah *et al*., 2022). The ineffective management of household solid waste has profound effects on public health. These effects encompass physical, biological, non-communicable diseases, psychosocial, and ergonomic health risks. Inefficient waste management provides breeding grounds for disease-carrying biological vectors like flies, rodents, and insects, leading to various diseases such as diarrhoea, dysentery, food poisoning, and respiratory issues (Fadhullah *et al*., 2022). Gases released from landfill waste, including methane and carbon dioxide, can cause inflammation and respiratory problems. Furthermore, there is a potential link between waste dumpsite pollution and certain cancers, birth defects, and cognitive issues (Gutberlet & Uddin, 2017). Colour-coded bins serve as a vivid and unmistakable reminder to households about the significance of waste separation. Their vibrant colours act as constant prompts, encouraging individuals to pause and consider the proper disposal of their waste (Amusan *et al*., 2018). In practice, these colour-coded bins typically represent several common categories of household waste: Blue bins identified by their blue colour, are intended for recyclables like paper, cardboard, glass, and plastic. Placing recyclable materials in the blue bin promotes responsible recycling practices, reducing the environmental impact and conserving valuable resources (Deva *et al*., 2019).

In Nigeria, the challenges of solid waste management are exacerbated by inadequate infrastructure, lack of public awareness, and insufficient government policies. The country generates an estimated 32 million tons of waste annually, with only about 20% being properly manage. In urban areas like Lagos and Port Harcourt, the situation is particularly dire, with overflowing dumpsites and poor waste collection services leading to environmental pollution and health hazards. The introduction of color-coded bins in Nigerian cities has been proposed as a viable solution to enhance waste segregation at the household level, thereby improving overall waste management practices. In Obio Akpor Local Government Area in Rivers State, the need for effective waste management strategies is urgent. The area has witnessed rapid urbanization, resulting in increased waste generation and inadequate disposal practices. Households often lack the necessary tools and knowledge to segregate waste effectively, leading to a reliance on open dumping and burning, which pose significant health and environmental risks. The implementation of a color-coded bin system could empower residents to take an active role in waste management by providing them with the means to sort their waste correctly. Green bins, marked with the colour green, are designated for organic waste, which includes food scraps, yard trimmings, and other biodegradable materials. Collecting organic waste in these bins supports the creation of compost, contributing to sustainable waste management and soil enrichment.

Yellow bins, featuring a yellow hue, are used for the safe disposal of hazardous materials commonly found in households, such as batteries and chemicals. Properly segregating these hazardous materials in the yellow bin prevents environmental contamination and potential health risks (Sahoo *et al*., 2022). Red bins, distinguished by their red colour, are reserved for non-recyclable and non-compostable household waste that is destined for landfill disposal. Placing such waste in the red bin ensures it undergoes appropriate waste management procedures (Deva *et al*., 2019). These bins, uniquely distinguished by specific colours, provide an intuitive and straightforward means for households to separate their waste effectively (Liu, 2018). By streamlining the sorting process of household solid waste, these colour-coded bins significantly raise the quality and purity of materials designated for recycling and composting (Leeabai *et al*., 2021). In the realm of visual communication, the impact of colour in elucidating recycling behaviours has been leveraged to decode the symbolism behind colours in recycling practices (Schloss *et al*., 2018).

Objectives of the Study

The general objective of the study was to investigate issues relating to utilization of colour-coded bins for management of household solid waste (HSW) in Obio Akpor Local Government Area (LGA) Rivers State. Specifically, the study determined:

(1) level of awareness of use of color-coded bins for HSW management among households in Obio Akpor LGA.
(2) level of utilization of colour-coded bins among households in Obio Akpor LGA.

(3) perceived benefits of use of colour-coded bins among households in Obio Akpor LGA.
(4) challenges households face in use of color-coded bins in Obio Akpor LGA.
(5) ways of enhancing the use of colour-coded bins by households in Obio Akpor LGA.

Methodology

***Design of the Study*:** This study employed survey research design

***Area of the Study*:** The area of the study was Obio Akpor Local Government Area (LGA) of Rivers State, Nigeria. It is situated approximately 10 kilometers from the state capital, Port Harcourt. The area encompasses several communities that are characterized by a mix of urban and semi-urban settings. It is one of the major cities in the state. There are many industries in the area. It is estimated that there are over 200 streets within the LGA. These streets range from major thoroughfares to smaller residential lanes, facilitating access to various neighborhoods and local amenities. The estimated number of households in Obio Akpor is approximately 60,000 to 80,000 reflecting the high population density and urban characteristics of the area (Tabansi *et al*.,2022).

***Population for the Study*:** Population for this study was made up of all households in the Obio Akpor LGA. The households are made up of different categories of socio-economic groups and classes. The homemakers in the households were the respondents in the study.

***Sample for the Study*:** Forty (40) streets were purposively selected for this study. Selection was based on the length of the street diversity of households in the street, accessibility of the street and waste management practices in the street. A total of 10 households were purposively selected from each street, to give a total 400 households. Only households that had waste bin were selected. One homemaker was selected from each household, to give a total of 400 homemakers.

***Instrument for data Collection*:** A questionnaire that consists of sections A and B was used for data collection. Section A consist of socio-demographic information, while section B comprised 25 items structured based on the specific objectives with a 4-point scale (strongly agreed (SA), Agree (A) Disagree (D) and Strongly disagree (SD). The instrument was validated by three expers in Home Management. Reliability of the instrument was established through test-retest. Twenty copies of the questionnaire were administered twice to 20 Home Management students who were not part of the population. Within two weeks interval, returned data were analyzed using Pearson's (R) Correlation Coefficient and the result was 0.83 correlation coefficient.

***Data collection Techniques*:** Four hundred copies of the questionnaire were administered with the help of two trained research assistant. At the end of the research exercise which lasted for one month, 381 copies were returned.

***Data Analysis Techniques*:** Data obtained were analysed using frequencies, percentages, and means. Based on the 4-point scale (1, 2, 3 and 4) of the instrument, a cut-off mean of 2.50 was used for decision making.

Results

Socio-demographic Characteristics of the Respondents

Data analysis on the socio-demographic characteristics of the respondents shows that majority of respondents (156(40.9%) are within the age bracket of 41 and 50years, 108(28.3%) of them are 50 years

and above, 98(25.7%) of them are within 31 and 40 years while 19((5%) are within 21 and 30 years of age. Majority of the respondents (300(78.5%) are males while 81(21.26%) are females. About 218 (57.22%) of the respondents had household size of 5-9 persons, followed by 83(21.75%) with household size of 10 and 80(21%) with the household size of 1-4 persons. The table also showed that more than half of the respondents (250(65.6%) attained primary level of education, 76(19.95%) have secondary education, 35(91.9%) have tertiary education while 20(5.2%) had no formal education. Most of the respondents are married [200(52.43%)], 80(21%) are single, 70(18.37%) are divorced while 31(8.14%) got separated from their husbands. About 158 (41.47%) representing majority of the respondents were civil servants followed by 106(27.82%) respondents who were into business. Most of the respondents (86.9%) have lived in the community for over 10 years.

Table 1: Percentage Responses on Level of Awareness of use of Colored-Coded Bins among Households in Obi Akpor LGA.

S/N	Awareness Indicators	A	NA
1	Goals of using the bins	274(71.92%)	107(28.08%)
2	What the colours stand for	267(70.08%)	114(29.92%)
3	Who is introducing such innovations	210(55%)	171(45%)
4	How innovations operate	263(69.03)	118(30.97%
5	Responsibilities of the households	68 (17.85%)	313(82.15%)
	Overall Percentage Awareness	57.26%	42.74%

N=381: N= Number of Respondents A= percentage respondent that are aware of the use of coloured-coded bins; NA= percentage respondents that are not aware of use of coloured-coded bins.

Table 1 shows that 274(71.92%) of the respondents are aware of the goals of using the bins while 107(28.08%) are not aware. Also 267(70.08%) of the respondents knows what the colour stands for while 114(29.92%) does not know what the colour stands for. Also 210 (55%) of the respondents know who is introducing such innovations while 171(45%) does not know who is introducing such innovations. About 293(69.03%) are aware of how the innovations operate while 118(30.97%) of the respondents are not aware of how it operates. Only 68 (17.85%) of the respondents know the responsibilities of the household members while 313(82.15%) does not know the responsibilities in using the coloured coded bins. The overall percentage awareness of respondents was 57.26%.

Table 2: Percentage Responses of Level/Extent of Utilization of Colour-coded Bin by Households in Obi-Akpor LGA.

S/N	Coloured Bins	AL%	SO%	NE%
	Level/Extent of Utilization Coloured-coded Bin:			
1	Yellow for contagious waste	30(7.87)	317(83.3)	34(8.92)
2	Red for highly contagious waste	31 (8.14)	40(10.50)	310(81.4)
3	Blue for glass	350(91.86)	15(3.94)	15(3.94)
4	Green for organic waste	308(80.8)	40(10.50)	33(8.66)
5	Brown for general waste	40(10.50)	300(78.74)	40(10.50)
	Overall percentage level of utilization	39.83	37.40	22.77

AL= Percentage of respondents that use always; SO = Percentage of respondents that use sometimes; NE = percentage of respondents that never use colour-coded bins.

Table 2 shows that while there is significant usage of certain colour-coded bins particularly blue for glass with 350 (91.86%) respondents and green for organic waste with 308 (80.80%) respondents, there is a notable inconsistency in the use of bins for contagious (Yellow) and highly contagious (Red) waste. This therefore suggests a need for enhanced awareness and education on the importance and proper use of all color-coded bins to improve waste segregation practices in the community. The percentage level of utilization of coloured-coded bins by household(39.83%) especially those who always use the bin is considered poor.

Table 3: Percentage Responses of the Perceived Benefits of the Use of Colour-coded Bins by Households in Obi Akpor LGA.

S/N	Benefits of Use of Colour-coded Bins	$\bar{X}$	SD	RMK
1	Use of colour-coded bins makes waste segregation easier	2.88	0.94	B
2	Colour-coded bins make for efficient collection	2.93	0.94	B
3	Colour-coded bins reduce cross-contamination	2.98	1.10	B
4	Colour-coded bins enhance visibility	2.96	1.04	B
5	Colour-coded bins improve healthier environment.	2.84	1.10	B
6	Promotion of sustainability and environmental stewardship	2.82	1.15	B
7	Empowerment of residents through active participation	2.21	0.64	NB
8	Increased recycling rates and reduced landfill waste	2.86	0.96	B
9	Provision of source of livelihood	3.02	1.20	B
10	Positive influence on neighboring households to adopt similar practices	2.53	0.79	B

$\bar{X}$ = Mean; SD = Standard deviation; RMK = Remark; B = Benefit; NB = Not benefit

Table 3 shows that the benefits of using colour-coded bins in household solid waste management among households in Obio/Akpor local government area of Rivers State with a grand mean and standard deviation values of 2.80 and 0.81, reveal that all the benefits identified (makes waste segregation easier, efficient collection, reduced cross-contamination, enhanced visibility and healthier environment and provision of source of livelihood) were the benefits except empowerment of residents through active participation which was not an accepted benefit of the use of colour-coded bins in household solid waste in this local government area.

Table 4: Percentage Responses on the Challenges Households faced in use of Coloured-coded Bins in Obi Akpor LGA.

S/N	Challenges of Use of Coloured-Coded Bins	$\bar{X}$	SD	RMK
1	Household Solid Waste (HSW) among respondents are littered around their environment.	2.88	0.94	C
2	HSW are not sorted and packaged properly according to their types	2.96	1.04	C
3	Issue of the use of coloured-coded bins is not taken seriously by household members.	2.98	1.00	C

Table 4 contd.

4	Visitors to the household members have a very wrong perception of the use of colour-coded bins.	2.93	0.90	C
5	Management of environmental health facilities does not have the right policy on HSW management.	2.84	1.00	C
6	Stigmatization of individuals who practice waste segregation	2.61	0.99	C
7	Insufficient availability of bins in neighborhoods	3.03	1.20	C
8	Fear of contamination and unpleasant odors	3.23	1.25	C
9	Vandalism or theft of bins	2.80	0.96	C
10	Inconsistent collection services from waste management authorities	2.58	0.98	C

$\bar{X}$ = Mean ; SD = Standard deviation; RMK = Remark; C = Challenge.

Table 4 shows that all the 10 challeges obtained mean scores of 2.50 and above ($\bar{X} \geq 2.50$). This implies that each item is a challenge faced by households in the use of colour-coded waste bins in Obio Akpor LGA.

Table 5: Percentage Responses of the ways of enhancing the use of Coloured -Coded bins by Households in Obi Akpor LGA.

S/N	Ways Of Enhancing The Use Of Coloured-Coded Bins	$\bar{X}$	SD	RMK
1	Coloured-coded bins should be classified correctly	3.23	1.03	WOE
2	Handlers of household waste should be properly educated.	2.92	1.10	WOE
3	HSW generated should be handled by knowledgeable individuals	3.17	1.01	WOE
4	HSW generated should include right documentation and disposal colour-code	3.11	1.07	WOE
5	HSW should be kept in the right containers and bags.	3.24	0.98	WOE
6	Place clear, easy-to-understand signage on the bins to avoid confusion	2.92	1.11	WOE
7	Introduce reward systems or recognition program for households that consistently use the bins	2.04	1.01	NWAE
8	Implement a system to monitor the effectiveness of the color-coded bin program	2.79	0.97	WOE
9	Collaborate with NGOs, schools, and community groups to promote the initiative and reach a wider audience.	3.15	1.15	WOE
10	Coordinate with waste management services to establish and communicate regular collection schedules	3.27	1.08	WOE

$\bar{X}$ = Mean ; SD = Standard deviation; WOE = Way of enhancing; NWOE = Not a way of enhancing; RMK=Remark

Table 5 reveals that nine items obtained means of 2.50 and above ($\bar{X} \geq 2.50$). This implies that these are nine ways of enhancing the use of colour-coded bins by households in Obi Akpor LGA.

Discussion

The study showed that the respondents having the awareness of the use of colour-coded bins with respect to awareness indicators (knowing goals of using the bins, what the colour stands for, who is introducing such innovations and how the innovations operate) in the area are low to

moderate. According to Udom (2024) level of education plays a crucial role in shaping individuals' participation in waste management such that higher education levels correlate with increased awareness, positive attitudes, and proactive behaviors regarding waste management practices since majority of the respondents were learned. The result also conforms to Adzawla *et al*., (2019) who asserted the importance of the decision on solid waste collection due to the influence of education. In industrialized areas, the amount of waste generated is high, but the awareness about waste management is lacking (Ferronato and Torretta 2019). The finding corresponded with the results of Njiru (2015) who opined that majority of respondents who were aware of use of coloured coded bins were learned nurses, teachers, doctors, engineers etc.

The low level of utilization of the coloured coded bins especially yellow and red which are sometimes and at times never used compared to the blue and brown which are the highest used by household is in consonance with the finding of Njiru (2015) who opined that choice of bins could be influenced by sex, level of exposure through education and among others. According to Kalaivani (2017) many residents lack awareness and understanding of the specific purposes of these bins, leading to confusion about what waste should be disposed of in them, which ultimately results in improper waste segregation practices. Kalaivani (2017) also opined that insufficient availability of bins in neighborhoods, coupled with inconsistent waste collection services, further discourages their use, as residents may find it more convenient to dispose of waste in general bins rather than seeking out the designated colour-coded

The identified perceived benefits (makes waste segregation easier, efficient collection, reduced cross-contamination, enhanced visibility and healthier environment and among others) in this study agreed with the findings of Ayodeji (2012) who noted that colour-coded bins facilitate better segregation of waste at the source and that the practice helps households to separate recyclable materials from general waste, ultimately reducing the volume of waste sent to landfills. According to Banga (2013), the use of colour-coded bins encourages households to participate in recycling programs. By clearly marking bins for different types of waste (e.g., recyclables, organic waste), residents are more likely to engage in recycling efforts, leading to increased recovery of valuable materials. Adeyemo & Gboyesola (2013) highlighted that adopting colour-coded bins raises awareness about environmental issues among households. The visual cues provided by the bins serve as constant reminders for residents to think about their waste management practices and their impact on the environment. According to Adeyemo & Gboyesola (2013), the systematic organization of waste through colour-coded bins can lead to more efficient waste collection and processing. Waste management authorities can better plan collection routes and schedules when waste is sorted effectively at the source.

The identified challenges households faced in the use of coloured-coded bins by households in Obi Akpor Local Government Area in this study are also in agreement with the finding of Ayuba (2013), Geng (2017); Adeyemo & Gboyesola (2013) but also opined that lack of awareness and community participation could be the other challenges

affecting households. The results of this work collaborated with the findings of both Ali *et al*. (2017) and Al Emadi (2011) contribute valuable insights into enhancing the use of color-coded bins in waste management and recommendations focus on public education, community engagement, policy support, and infrastructure improvements, all aimed at promoting effective waste segregation practices in the area. According to Snehal *et al*.(2022) Often, due to poor separation practices, some solid waste especially hospital waste is mixed with general waste, resulting in harmful overall waste flow and that waste disposal handlers are not safe due to their exposure to various health risks and inadequate training in waste management. In a study, Singh & Gupta (2019) identified key challenges related to vandalism and theft of public waste bins, including increased maintenance costs and reduced availability of bins, which lead to improper waste disposal and littering in urban environments. These issues not only compromise the efficiency of waste management systems but also negatively impact public perception and community engagement in maintaining cleanliness.

Conclusion

The study on the utilization of colour-coded bins for the management of solid waste among households in Obio Akpor LGA, reveals several critical insights. While the implementation of colour-coded bins has the potential of significantly enhancing waste segregation and promote responsible waste management practices, the actual utilization remains suboptimal. Certain factors such as lack of awareness, inconsistent availability of bins, and cultural attitudes towards waste disposal contribute to this challenge. Despite that these barriers remain issues of concern, there is a notable interest among residents in adopting better waste management practices when provided with adequate information and resources.

Recommendations

1. Local authorities should ensure that colour-coded bins are consistently available and well-maintained throughout the community.
2. Introducing incentive programs for households that demonstrate effective waste segregation could encourage more residents to participate actively in the initiative.
3. Providing targeted training sessions for households on how to effectively use colour-coded bins can improve utilization rates.

References

Adzawla, W., Tahidu, A., Mustapha, S., Azumah, S.B., (2019). Do socioeconomic factors influence households' solid waste disposal systems? Evidence from Ghana. Waste Manag. Res. 37 (1), 51–57.

Adeyemo, F.O. and Gboyesola G.O (2013). Konwledge, attitude and practices on waste management of people living in the university area of Ogomoso Nig. *Journal of Enironment Ecology, Family and Urban Studies. 3. 51-56*

Al Emadi, A. (2011). *Waste management in the Gulf Cooperation Council countries: A review of the current status and future challenges. Waste Management*, 31(4), 661-668.

Ali, M., Wang, W., Chaudhry, N., & Geng, Y. (2017). Hospital waste management in developing countries: A mini review. *Waste Management & Research*, 35(6), 581-592.

Amusan, L. M., Ojo, J. A., & Ojo, A. O. (2018). Waste disposal practices and environmental implications in Nigeria: A

review. *Environmental Science and Pollution Research*, 25(12), 11500-11510.

Ayodeji, I. (2012) Waste Management Awareness, Knowledge and Practices of Secondary Schoolteachers in Ogun State, Nigeria. *The Journal of Solid Waste Technology and Management*, 37, 221-234.

Ayuba K.A., AbdMnaf L., Sabrina, A.H. and S.W. Nur Azim (2013). Current Status of Municipal Solid waste management in F.C.T Abuja. *Research Journal of Environmental and Earth Sciences* 5 (6): 295 – 304.

Banga, M. (2013) Household Knowledge Attitudes and Practices in Solid Waste Segregation and Recycling: The Caseof Urban Kampala. *Zambia Social Science Journal*, 2, 27-39.

Deva, A. N., Arun, C., Arthanareeswaran, G., & Sivashanmugam, P. (2019). Extraction of peroxidase from waste Brassica oleracea used for the treatment of aqueous phenol in synthetic waste water. *Journal of Environmental Chemical Engineering*, 2(2), 1148-1154.

Fadhullah, M., Ahmad, A., & Rahman, M. (2022). Title of the paper. *Journal Name*, Volume(Issue), Page range. DOI or URL if available

Ferronato, N. and Torreta V. (2019). "Waste Management in Developing Coutries. A review of global issues. *International journal of* environmental research and public health. 16.1060.(2).

Geng, Y. (2017). The role of waste management in sustainable development: A review of the literature. Waste Management, 61, 1-10.

Gutberlet, J. & Uddin, S.M.N. (2017). Household waste and health risks affecting waste pickers and the environment in low- and middle-income countries. *International Journal of Occupational Environmental Health*., 23(4):299-310.

Gutberlet, J. (2011). Waste to energy, wasting resources and livelihoods. *Integr Waste Manag*., 1: 219–236. Sunil Kumar (Ed.), ISBN: 978-953-469-6, In Tech.

Kalaivani A (2017). Exploring the Application of Colour Coding For Quality Health Care. *Journal of comprehensive health*, 5(2);74-76.

Leeabai, N., Areeprasert, C., Khaobang, C., Viriyapanitchakij, N., Bussa, B., Dilinazi, D., & Takahashi, F. (2021). The effects of color preference and noticeability of trash bins on waste collection performance and waste-sorting behaviors. *Waste Management,* 121: 153–163.

Liu, J. (2018). Effective waste separation: Strategies and impacts on recycling behavior. *Waste Management*, 75, 123-130.

Njiru, M.W (2015) Assessment of the awareness and practice on medical waste Management among Healthcare personnel at Kenyatta National Hospital, in Nairobi. An unpublished Msc Thesis, Jomo Kenyatta University of Agriculture and Technology.

Nwosu, A.O. & Chukwueloka, H.E. (2020). A Review of Solid Waste Management Strategies in Nigeria. *Journal of Environment and Earth Science*, 10(6): 131-143.

Omer, M.A. (2021). Effect of Household Solid Waste Management on Environmental Sanitation in Hargeisa, Somaliland. *International Journal of Environmental Protection and Policy*, 9(2): 27-32.

Sahoo, K.C., Soni, R., Kalyanasundaram, M., Singh, S., Parashar, V., Pathak, A., Purohit, M.R., Sabde, Y., Stålsby, Lundborg, C., Sidney, Annerstedt, K., Atkins, S., Rousta, K. &Diwan, V. (2022). Dynamics of Household Waste Segregation Behaviour in Urban Community in Ujjain, India: A Framework Analysis. *International Journal of Environmental Research and Public Health*, 19(12):7321.

Schloss, A. R., Hargreaves, T., & Evans, D. (2018). The role of color symbols in waste management and recycling: Enhancing public understanding and participation. *Waste Management & Research*, 36(3), 239-247.

Singh, S., & Gupta, A. (2019). "Vandalism and theft of public waste bins: A study in urban environments." Urban Forestry &

Urban Greening, 46, 126-134. DOI: 10.1016/j. ufug.2019.126134

Snehal S. Manekar1, Ravindrakumar L. Bakal1, Rahul D. Jawarkar1 and Manoj S. Charde (2022). Challenges and measures during management of mounting biomedical waste in COVID-19 pandemic: an Indian approach. Bulletin of the National Research Centre

Tabansi C.K, Tamunotonye H, Uchechukwu A (2022).Willingness to Enroll in Social Health Insurance and associated factors among Household Heads in Obio/Akpor Local Government Area of Rivers Stat e. MRXIV. https://doi.org/10.1101/ 2022 .12 . 19. 22283656

Uddin, S.M.N., Li, Z., Adamowski, J.F., Ulbrich, T., Mang, H., Ryndin, R., Norvanchig, J., Lapegue, J., Wriege-Bechthold, A. & Cheng, S. (2016). Feasibility of 'greenhouse system' for household greywater treatment in nomadic-cultured communities in peri-urban ger areas of Ulaanbaatar, Mongolia: way to reduce greywater-borne hazards and vulnerabilities. *J Clean Prod*., 114:431–442.

Udom O (2024). Attitude of Rumueme Community towards Solid Waste Management in Obio-Akpor Local Government Area of Rivers State. Journal of Pollution Monitoring, Evaluation Studies and Control, 3(1),30-35