Impacts of Storage Duration and Materials on the Quality of Rainwater in Ogbomoso, Southwest Nigeria

T.P. Abegunrin[1], G.O. Awe[2]*, A.Y. Sangodoyin[3], O.E. Onofua[1] and O.M. Oguntoye[1]

[1]Department of Agricultural Engineering, LadokeAkintola University of Technology, Ogbomoso, Nigeria
[2]Department of Soil Resources and Environmental Management, Ekiti State University, Ado Ekiti, Nigeria
[3]Department of Agricultural and Environmental Engineering, University of Ibadan, Ibadan, Nigeria
Corresponding author

A B S T R A C T

Alternative water sources for potable or non-potable purposes are now sought as a result of the global crisis of water shortage and rainwater harvesting is one of the several strategies for mitigating the growing water crisis. However, one of the primary issues regarding the use of rainwater is quality. The objective of this study therefore was to examine the combined effects of storage duration and materials on the physico-chemical and microbiological qualities of harvested rainwater in Ogbomoso, southwestern Nigeria. Samples of harvested rainwater were kept in three different storage materials, namely metal drum (M), plastic drum (P) and earthen pot (E) for one day (D1), five days (D5) and ten days (D10) before analysis for quality indicators of physical, chemical and biological characteristics. Storage material had significant effect on the quality indicators except temperature, chloride (Cl) and nitrite (NO_2)with earthen pot most significantly influencing the quality of the harvested rainwater. Except for temperature, total solids (TS), nitrate (NO_3) and total coliform (TC), storage duration did not significantly affect the quality indicators. As the storage duration increases, the introduction of contaminants increased the electrical conductivity (EC), TS and TC. There was significant correlation between the harvested rainwater quality indicators and of all the quality indicators, only changes in water temperature and chloride can be best predicted over time. This study shows that harvested rainwater for potable purposes should not be stored more than five days without adequate treatment and the use of plastic drum is recommended for storing rainwater. Nevertheless, care must be taken when storing rainwater from the introduction of foreign contaminants while proper handling must be ensured.

Introduction

Freshwater is an essential requirement for human existence. At the domestic level, water of acceptable quality at reasonable quantity is required for normal physiological needs and for sanitary purposes. Over the last half-century, water demand has increased and signs of water shortage have become common place (Miller, 1989; IPPC, 1990; Matondo *et al.,* 2005; Kaldellis and Kondili, 2007). The shortage of water may be attributed to some

factors among which are complexity in lifestyles, competition for freshwater among the various users (agriculture, industry, domestic and recreation), population increase, total or partial failure of conventional methods of water supply (Pinfold *et al.,* 1993; Sangodoyin, 1993; Abegunrin, 2014).

As a result of the global crisis of potable water shortage, alternative water resources are sought and rainwater harvesting is a major method among several strategies for mitigating the growing water crisis (Ayoade *et al.,* 1998; Cooker, 1999; Lucas *et al.,* 2005; Hatibu *et al.,* 2006; Hartung, 2007; Ghisi and Ferreira, 2007). Rainwater, according to Thomas (2000) is considered to be purer for potable or non-potable purposes than water from other sources. Although rainwater has been reported to be relatively acceptable quality for many purposes (Ariyabandu, 1999; Li *et al.,* 2000; Andrew-Lo, 2003), however, one of the primary issues regarding the use of rainwater is quality (Despins *et al.,* 2009).

Deteriorations during harvesting, catchment material, storage and household use have been reported (WHO, 2011). External pollution sources such as proximity to major roads or heavy industries, the presence of birds or rodents have the potential to affect rainwater quality (Simmons *et al.,* 2001; Chang *et al.,* 2004; Zhu *et al.,* 2004; Sazakli *et al.,* 2007; Abegunrin *et al.,* 2014). According to Forter (1999) and Lee *et al.,* (2010), heavy metals have been found in harvested rainwater while Ahmed *et al.,* (2008) reported the presence of pathogenic bacteria. Cleanliness, age and type of catchment, atmospheric conditions and storage also contribute to the quality of harvested rainwater (Yaziz *et al.,* 1989; Simmons *et al.,* 2001; Chang *et al.,* 2004; Zhu *et al.,* 2004; WHO, 2011).

Storage may be a source of contamination to harvested rainwater over time. While storage

in cisterns is somewhat considered to enhance the quality of rainwater, however there is concern over the potential for chemical (Despins *et al.,* 2009). For instance,one study reported significant leaching of zinc from metallic storage tank. To the best of our knowledge, we are not aware of any reported work on the combine effects of storage duration and materials on the quality of harvested rainwater in Ogbomoso, southwestern Nigeria.

We hypothesized that materials and duration of storage have significant effects on the quality of harvested rainwater. This study therefore examined the combined effects of storage duration and materials on the physico-chemical and microbiological qualities of harvested rainwater in Ogbomoso, Southwestern Nigeria.

Materials and Methods

Description of the study area

The study was carried out in Ogbomoso township (8° 10`N, $4^o$ 10`E) southwest Nigeria. Ogbomoso Township comprises of Ogbomoso South Local Government (OSLG) and Ogbomoso North Local Government (ONLG) (Figure 1). The mean annual rainfall is about 1200 mm and the mean maximum and minimum temperatures are 33 and 28^oC, respectively. The relative humidity of the area is relatively high (approximately 74%) throughout the year except in January when the dry wind blows from the North (Olaniyi *et al.,* 2010). Majority of the residents depend on groundwater (Adetunde *et al.,* 2011) due to inadequate supply from the Ogbomoso zone of the Oyo State Water Corporation (Toyobo *et al.,* 2011). Toyobo (2013) however reported that most households have no access to well and borehole water due to their poor income. This situation forced many residents to collection and storage of rainwater in

different storage facilities available to meet their water demands for few days.

Water sample collection

A preliminary survey of the common storage materials in use was carried out and it was found that the major storage materials in use are metals (M), usually used oil drums, PVC tanks (P), mostly black colour and earthen pots (E). These common storage materials were used for this study. The three types of storage materials were purchased, thoroughly washed and kept under the same conditions. Rainwater was collected on a galvanized iron roofing sheet and same quantity of 100 litres was kept in each storage type. The roof was allowed to be cleaned by allowing rainwater to run over it for sometimes before the water for storage was collected as recommended by Yaziz *et al.,* (1989).

A total of 162 samples were collected; 81 samples from each of OSLG and ONLG, respectively. In each of the local governments, 27 samples (in triplicates) were collected from each of the storage type. This translates to 9 samples from each storage duration (1, 5 and 10 days after storage, designated as D1, D5 and D10, respectively). The sample bottles used have been previously soaked in diluted HNO_3 acid for 24 hours after which they were thoroughly washed with detergent and rinsed with distilled water. The water samples were collected in the treated samples bottles.

Samples for heavy metals were acidified with concentrated HNO_3 to keep the metals in solution and to minimize their adsorption to the wall of the sample bottles. Samples for microbial analysis were kept in sterilized capped bottles to curb further growth of bacteria. All sample bottles were kept in ice-pack and transported to the laboratory immediately.

Laboratory analysis

The physico-chemical parameters tested include pH, total hardness (TH), turbidity, electrical conductivity (EC) temperature, total solids (TS), Ca^{2+}, Mg^{2+}, Al^{3+}, Pb^{2+}, Cl^-, NO_3^{2-}, NO_2^{2-}. Microbial parameters analyzed were Total Bacterial Count (TBC)and Total Coliform Count (TC). Each water sample was analyzed based on the procedures described by APHA (1998).

Statistical analysis

Analysis of variance (ANOVA) was carried out on the water physical, chemical and microbiological characteristics and Fisher's LSD test was used to determine significant difference between individual means at 5% level of probability. Statistical analyses were done using SPSS (version 20).

Results and Discussion

Effect of storage materials on harvested rainwater quality

The results of the effects of storage materials on the physico-chemical and microbiological properties of rainwater are presented in Figure 2. Values of pH of water from the different storage materials were recorded as 6.41, 6.39 and 8.06 for metal drum (M), plastic drum (P) and earthen pot (E), respectively. The pH of water in metal and plastic storage materials were within the slightly acidic range while that of earthen pot was 8.06 and within the slightly alkaline range (Figure 2 a). The pH value of water in plastic material may be the actual pH value of the rainwater since PVC is inert. The pH value of water in storage earthen pot was significantly different from those in metal and plastic storage materials. The alkaline pH of water (>7.0) recorded in earthen pot may be due to the material from which the pot is made of. It is suspected that the material of the earthen pot contain some

calcium salt that has been dissolved by the water stored in it. Water with pH>11 has been reported to cause eye irritation and exacerbation of skin disorders while water with pH<4 was found to cause redness and eye irritation, the severity of which can increase with decreasing pH (WHO, 1986). Furthermore, water with high (>11) or low (<6.5) pH can lead to corroding of water supply pipes and fittings. Thus, the average pH values of the rainwater observed in our study indicate "safe" in terms of public health.

The average values of water temperature in metal drum, plastic drum and earthen pot were 23.92, 24.17 and 24.17^{o}C, respectively. These values showed no significant differences, in other words, the storage media did not significantly affect the temperature. The insignificant effect of material on water temperature is attributed to sampling done during summer time in which there is no much variation in ambient temperature.

The mean values for turbidity from the different storage media showed significant differences with highest value of 6.26 NTU obtained in water stored in metal drum and lowest for water stored in plastic drum (1.68 NTU) with earthen pot having a value of 1.95 NTU. Electrical conductivity values of water samples from the storage materials were 20.93, 23.26 and 180.29μS/cm in metal drum, plastic drum and earthen pot, respectively (Figure 2 a). The value EC for water stored in the earthen pot was highest and significantly different from those in the metal and plastic drums. This may be due to the dissolution of particle of materials from the earthen pot into the water. The average values of TS of the rainwater sampled from the different storage materials were 86.10, 102.04 and.132.94 mg/L for the metal drum, plastic drum and earthen pot, respectively. The mean value observed in earthen pot was significantly

different from those in metal and plastic drums. This also may be due to the particles from the earthen pots that have dissolved in the water. From the observation in the different storage media, total hardness (TH) value of zero (0) was recorded for metal and plastic storage materials while 59.06 mg/L was observed in earthen pot (Figure 2 a). This may also be attributed to the release of the component materials of the earthen pot.

The average values of Cl obtained for water stored in metal drum, plastic drum and earthen pot were 5.45, 5.33 and 6.59 mg/L, respectively, with no significant difference (p < 0.05) in Cl concentration of water from all the three storage media (Figure 2 b). Nitrate (NO$_3$) values in the different storage materials also showed significant differences with values 0.02, 0.12 and 0.36 mg/L recorded respectively for metal drum, plastic drum and earthen pot. The average concentration of NO$_2$ from metallic drum, plastic drum and earthen pot was 1.23, 0.01 and 0.20 mg/L, respectively, without significant differences among the storage materials.

Ca and Mg were not recorded in metal and plastic storage drums while 6.36 mg/L Ca and 1.45 mg/L Mg were recorded in earthen pot (Figure 2 c). The values recorded in the earthen pot may be due to the material from which the pot is made of. It is suspected that the material of the earthen pot contain some calcium and magnesium salts that have been dissolved. Trace metals Pb and Al were not detected in the water samples for the different storage materials (Figure 2 c). The absence of these toxic metals is desirable because of the danger they pose to human health.

The total bacterial count (TBC) was significantly different in the storage media with average values highest in plastic drum (362.00 MPN/100ml) and lowest in earthen pot (105.11 MPN/100ml) (Figure 2 d). The

lowest value in the earthen pot could be as a result of pH value of the rainwater as water sampled from earthen pot had the highest value of pH. Studies have found some correlations between pH and growth of coliforms in rainwater tanks (Zhu *et al.,* 2004). In agreement with our findings, Achadu *et al.,* (2013) also reported highest values of TBC in plastic storage medium. Total coliform (TC) was 10.56, 9.11 and 33.89 CFU/100ml in storage materials made of metal, plastic and earthen pot, respectively (Figure 2 d), and these values differed significantly. This difference could be as a result of variations in water handling in the different storage types.

Effect of storage duration on rainwater quality

The results of the effects of storage duration on the physico-chemical and microbiological properties of harvested rainwater are presented in Figure 3. The average pH values of the harvested rainwater stored for one day(D_1), five days (D_5) and ten days (D_{10})were 6.79, 7.04 and 7.02, respectively (Figure 3 a). These values were within the acceptable range of6.5 – 8.5 for drinking water standards (WHO, 2011; NSDWQ, 2007), and complied with the previous findings of other studies (Olaoye and Olaniyan, 2013; Abegunrin *et al.,* 2014). In our study, there was no significant difference ($p < 0.05$) in the average pH values from the different storage periods.

Significant difference ($p < 0.05$) was observed in the temperature of the water for the different storage duration. The mean temperatures were 26.97, 17.77 and 27.52°C for storage durations one, five and ten days, respectively. The difference in temperature may be attributed to ambient conditions which vary with time. The turbidity was least (3.05 NTU) for one day and highest (3.65 NTU) after five days of storage. Although the

values of turbidity in the water stored for different duration were not the same, the differences were not statistically difference. Nevertheless, the variation in the values of turbidity may be due to the presence of settle able particles in water as well as the effect of environmental conditions. After the first day of storage (D_1), some settleable particles may have settled and thus reduced the turbidity. However, higher value after five days of storage (D_5) may be due to "disturbance" of the stored water causing the settled particles to mix with the water and raise the turbidity level once again. The lower value of 3.20 NTU after ten days of storage (D_{10}) could be due to resettlement of the settleable particles when the stored water is in quiescent condition. The average values of electrical conductivity (EC) were 53.43, 72.33 and 98.72 µS/cm for one, five and ten days of storage respectively. The EC values of the stored water for the three storage durations showed an increasing trend from one day to ten days though the values are not statistically different ($p < 0.05$).

The increased trend indicated that more particles were dissolved in the stored water as storage duration is increasing. The total solid (TS) increased with storage duration (91.01, 98.67 and 131.40 mg/L for one, five and ten days, respectively) with significant differences ($p < 0.05$)observed among the different storage durations. This increase in TS may be due to the dissolution of more particles in the stored water as storage duration increases.

In deviation to the trend observed in EC and TS, the values for total hardness fluctuated for storage duration. The TH values for one, five and ten days of storage were 26.44, 6.50 and 26.11 mg/L, respectively (Figure 3a). The values for one and ten days of storage did not differ significantly ($p < 0.05$) however they differed significantly from that of five days of storage.

Table.1 Interactive effect of storage duration and type of storage material on the physical properties of the harvested rainwater

Duration	Material	pH	Temp.	Turb.	EC	TS	TH
		-	(°C)	(NTU)	(μS/cm)	-----------(mg/L)-----------	
	M	6.33	26.9	5.33	21.0	56.1	6.00E-15
D1	P	6.40	26.9	1.69	21.4	92.3	7.77E-16
	E	7.63	27.1	2.12	117.8	124.6	7.93E+01
	M	6.47	17.8	6.51	20.5	74.0	0.00E+00
D5	P	6.37	18.0	1.92	17.9	90.8	0.00E+00
	E	8.30	17.5	2.51	178.7	131.3	1.95E+01
	M	6.43	27.0	6.95	21.3	128.2	0.00E+00
D10	P	6.40	27.6	1.43	30.5	123.0	1.42E-14
	E	8.23	28.0	1.22	244.4	142.9	7.83E+01
D x Mat.		s	s	s	s	s	s

Temp = Temperature;Turb = Turbidity; EC = Electrical Conductivity; TS = Total Solid;TH = Total Hardness
D1: storage for 1 day; D5: storage for 5 days; D10: storage for 10 days; M: metal storage structure; P: Plastic storage structure and E: earthen pot.
D x Mat: interaction between storage duration and material; s: significant difference at 5% level of probability by LSD test.

Table.2 Interactive effect of storage duration and type of storage material on chemical properties of the harvested rainwater

Duration	Material	Ca	Mg	Al	Pb	Cl⁻	NO_2	NO_3
		---mg/L---						
	M	0.00	0.00	nd	nd	4.02	0.03	3.67
D1	P	0.00	0.00	nd	nd	4.48	0.04	0.02
	E	9.20	1.45	nd	nd	5.40	0.85	0.42
	M	0.00	0.00	nd	nd	5.32	0.00	0.01
D5	P	0.00	0.00	nd	nd	4.45	0.03	0.01
	E	6.47	1.10	nd	nd	5.44	0.03	0.02
	M	0.00	0.00	nd	nd	7.00	0.01	0.00
D10	P	0.00	0.00	nd	nd	7.05	0.31	0.01
	E	3.41	1.80	nd	nd	8.92	0.22	0.15
D x Mat.		s	s	-	-	s	s	s

Ca: calcium; Mg: magnesium; Pb: lead; Al: aluminum; Cl: chloride; NO_3: nitrate;NO_2: nitrite
D1: storage for 1 day; D5: storage for 5 days; D10: storage for 10 days; M: metal storage structure; P: Plastic storage structure and E: earthen pot.
D x Mat: interaction between storage duration and material; s: significant difference at 5% level of probability by LSD test; nd: not detected

Table.3 Parameters A, B and C of the regression equations and coefficient of determination (R2) for the quality indicators of harvested rainwater

Property	Fitting parameters			R^2
	A	B	C	
pH	0.0076	0.109	6.687	0.0209
Temp.	0.4723	-5.134	31.628	0.9966
Turb.	-0.0267	0.309	2.767	0.0138
EC	0.0614	4.356	49.016	0.0534
TS	0.5147	-1.175	91.672	0.3912
TH	0.9898	-10.925	36.38	0.0839
Ca	0.0027	-0.244	3.308	0.0573
Mg	0.0084	-0.079	0.556	0.0181
Cl	0.0454	-0.164	4.753	0.8016
NO_3	0.0115	-0.141	0.436	0.2049
NO_2	0.0386	-0.571	1.904	0.3089

Temp. = Temperature;Turb = Turbidity; EC = Electrical Conductivity; TS = Total Solid;TH = Total Hardness; Ca: calcium; Mg: magnesium; Pb: lead; Al: aluminum; Cl: chloride; NO_3: nitrate; NO_2: nitrite
R^2: Coefficient of determination

Table.4 Pearson correlation among the evaluated quality indicators of the harvested rainwater

| Par.	pH	Temp.	Turb.	EC	TS	TH	Ca	Mg	Cl	N-NO$_3$	N-NO$_2$
pH	1										
Temp	-0.065	1									
Turb	-0.413*	-0.145	1								
EC	0.959**	0.052	-0.458*	1							
TS	0.621**	0.222	-0.377	0.615**	1						
TH	0.769**	0.316	-0.433*	0.802**	0.522**	1					
Ca	0.797**	-0.016	-0.357	0.687**	0.480*	0.783**	1				
Mg	0.937**	0.141	-0.459*	0.942**	0.594**	0.938**	0.826**	1			
Cl	0.442*	0.391*	-0.167	0.577**	0.697**	0.478*	0.107	0.495**	1		
N-NO$_3$	0.348	0.410*	-0.403*	0.301	0.354	0.729**	0.709**	0.556**	0.168	1	
N-NO$_2$	-0.079	0.157	0.180	-0.102	-0.099	-0.066	-0.075	-0.090	-0.226	-0.037	1

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).
Temp = Temperature;Turb = Turbidity; EC = Electrical Conductivity; TS = Total Solid;TH = Total Hardness

Fig.1 Map of Ogbomoso Township, southwest Nigeria
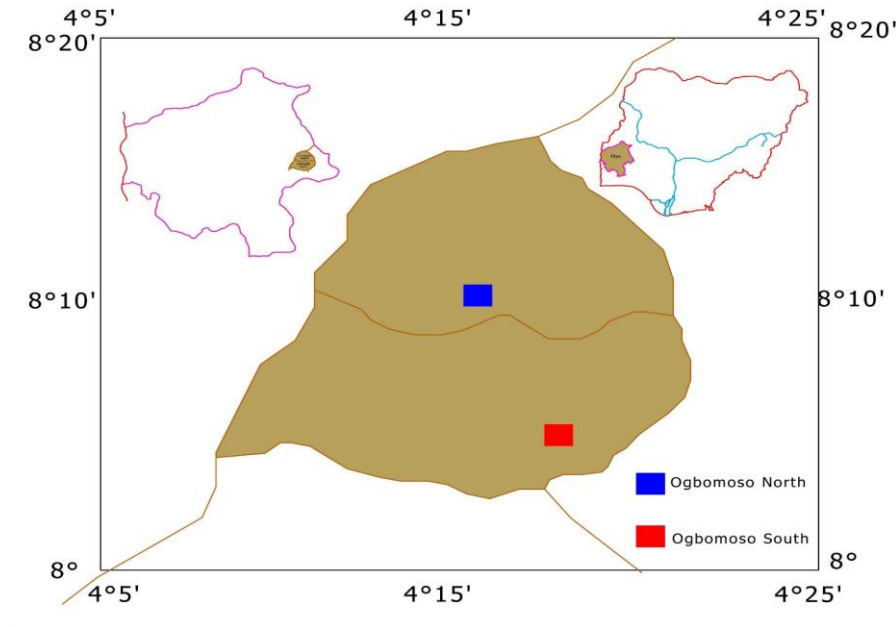
Fig.2 Effects of storage materials on a) physical properties, b) nitrates and chloride, c) cations and d) microbiological properties of harvestedrainwater
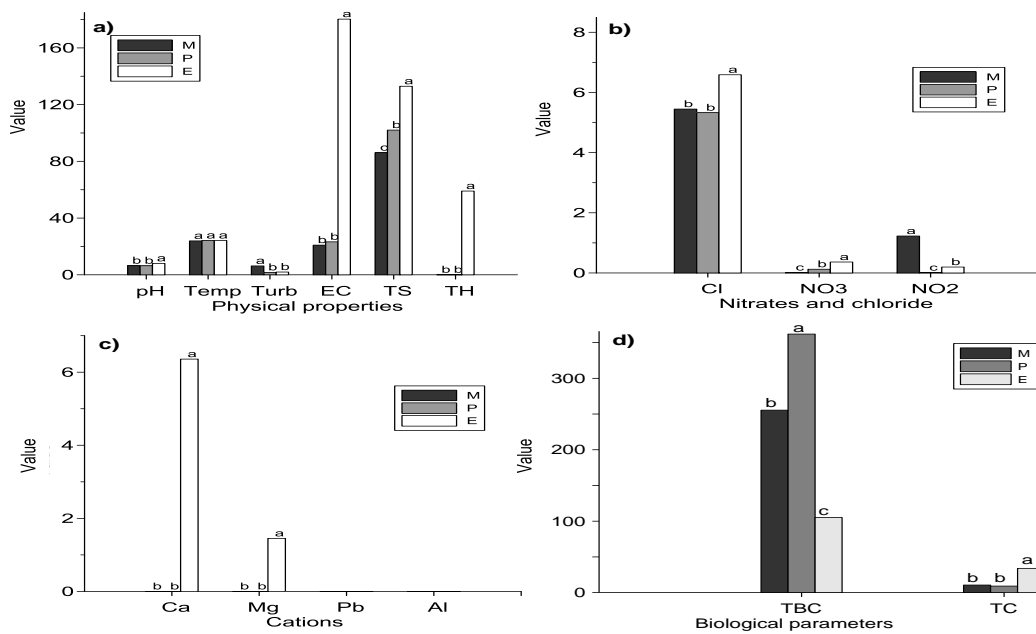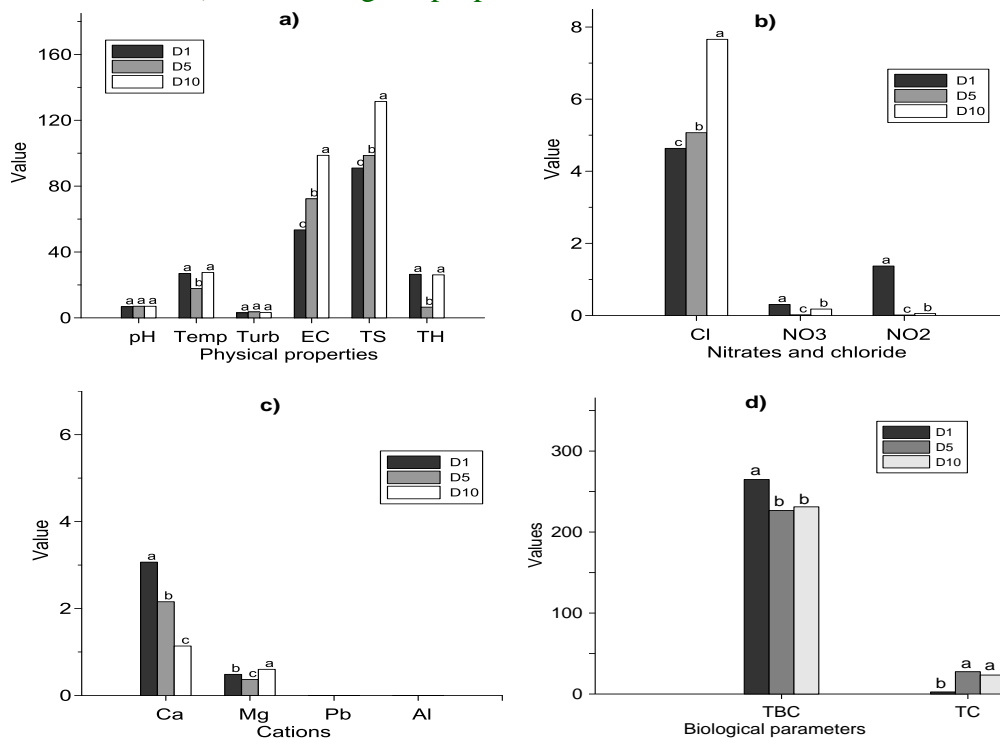

Temp = Temperature(^{o}C);Turb = Turbidity(NTU); EC = Electrical Conductivity(μS/cm); TS = Total Solid (mg/L);TH = Total Hardness (mg/L); Cl: chloride, mg/L; NO$_3$: nitrate, mg/L; NO$_2$: nitrite, mg/L; Ca: calcium, mg/L; Mg: magnesium, mg/L; Pb: lead, mg/L; Al: aluminum, mg/L; TBC: total bacterial count, MPN/100ml; TC: total coliform, CFU/100ml.
M: metal storage structure; P: Plastic storage structure and E: earthen pot.
Bars with different letters differed significantly at 5% level of probability by Fisher's LSD test.

Fig.3 Effects of storage duration on a) physical properties, b) nitrates and chloride, c) cations and d) microbiological properties of harvested rainwater

Temp = Temperature(^{o}C);Turb = Turbidity(NTU); EC = Electrical Conductivity(μS/cm); TS = Total Solid (mg/L);TH = Total Hardness (mg/L); Cl: chloride, mg/L; NO_3: nitrate, mg/L; NO_2: nitrite, mg/L; Ca: calcium, mg/L; Mg: magnesium, mg/L; Pb: lead, mg/L; Al: aluminum, mg/L; TBC: total bacterial count, MPN/100ml; TC: total coliform, CFU/100ml.
D1: storage for 1 day; D5: storage for 5 days; D10: storage for 10 days
Bars with different letters differed significantly at 5% level of probability by Fisher's LSD test.

There were differences in the values 4.63, 5.07 and 7.66 mg/L of Cl observed for storage durations of one, five and ten days, respectively (Figure 3b). These differences are however not significant (p < 0.05). The average values of nitrate (NO_3) were significantly different for the storage duration, with values 0.31, 0.02 and 0.18 mg/L recorded for D_1, D_5 and D_{10}, respectively. The average concentration of NO_2 for one, five and ten days of storage was 1.37, 0.01 and 0.05, respectively. These values were not significantly different. The average values of Ca and Mg for one, five and ten days of storage, respectively were 3.07, 2.16 and 1.14 mg/L and 0.48, 0.37 and 0.60 mg/L. There was no significant difference in both the Ca and Mg levels for the three storage durations

(Figure 3c). The decreasing values in Ca level may be attributed to the settlement of particles in the water as the storage duration increases. Trace metals Pb and Al were not detected in the water samples for the different storage durations.

Rainwater stored for one day (D_1) had the highest total bacterial count (TBC) value of 264.89 MPN/100ml while five days (D_5) of storage had the least value of 226.56 MPN/100ml (Figure 3d). The decrease in the TBC may be attributed to the condition of storage such as presence of light or otherwise. The difference in the TBC of the stored rainwater was however not significant. The total coliform (TC) for one, five and ten days of storage were 2.56, 27.56 and 23.44

CFU/100ml, respectively. The TC of water sample after one day of storage differed significantly (p<0.05) from those stored for five and ten days, but the TC of water stored for five days did not differ from that stored for ten days. This significant higher TC after five and ten days compared to just a day could be as a result of exposure to contamination by birds and rodents as well as unhygienic water handling practices which involves unsanitary use of utensils and hands touching the water. This result agrees with studies carried out by Pinfold (1990) who found that the most common route of contamination of stored water or the presence of coliform bacteria in stored water is through water handling such as dipping.

Interactive effect of storage duration and material on rainwater quality

The interactive effect of both storage duration and storage materials on the physical and chemical quality indicators of harvested rainwater is presented in Tables 1 and 2. The interactive effect of both storage duration and storage materials was significant (p < 0.0) for all the physical parameters evaluated (Table 1). Similarly, the interactive effect of both storage duration and storage materials was significant (p < 0.0) for all chemical characteristics except Al and Pb that were not detected (Table 2).The significant interaction observed on rainwater quality indicators indicates that both storage duration and materials could co-limit these indicators.

Irrespective of storage material, the regression analysis carried out on the rainwater quality indicators with storage time showed that changes in rainwater quality indicators over time can be best predicted using polynomial fitting of the second degree as:

$$QI = At^2 + Bt + C \ldots\ldots\ldots\ldots\ldots\ldots 1$$

where QI is a quality indicator; t is storage time, days; A, B, C fitting parameters.

The parameters (A, B and C) of the regression equations as well as the coefficient of determination (R^2) for the quality indicators of harvested rainwater are presented in Table 3. Even with the polynomial fitting, only changes rainwater quality indicators of water temperature and chloride can be effectively predicted over time. Amin *et al.,* (2013) found exponential fitting for predicting changes in microbial water quality of harvested rainwater over time.

Correlation between properties

The results of the pearson correlation analysis of the quality indicators of the rainwater are presented in Table 4. Except for water temperature and N-NO$_2$, there was significant correlation between the quality indicators. For example, the pH showed significant (p<0.05) positive correlation with EC, TS, TH, Ca, Mg and Cl, the highest with EC while the correlation was negative and significant for temperature and turbidity. The turbidity correlated significantly with EC, TH, Mg and N-NO$_3$, however the correlation was negative. The EC had significant and positive correlation with TS, TH, Ca, Mg and Cl. Both TS and TH correlate significantly with Ca, Mg and Cl.

It can be concluded that the study assessed the impacts of short term storage duration and material on the quality of harvested rainwater. Storage type had significant differences on the quality indicators except for temperature, Cl and NO$_2$ whereas storage duration did not significantly affect the quality indicators except for temperature, TS, NO$_3$ and TC.

Earthen pot most significantly influenced the quality of the water due to the high tendency of its constituent component to get dissolved in the water. As the storage duration increases, there is a great likelihood of the introduction of contamination particles as evidenced with the increasing trend of EC, TS and TC. There was significant correlation between the rainwater quality indicators and of all the quality indicators, only changes in water temperature

and chloride can be best predicted over time.

This study shows that harvested rainwater for potable purposes should not be stored more than five days without adequate treatment and the use of plastic drum is recommended for storing rainwater. Nevertheless, care must be taken when storing rainwater from the introduction of foreign contaminants while proper handling must be ensured.

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