Effects of Plastic Storage Containers and Time on Potable Water

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ABSTRACT

Water tanks are liquid storage containers that store water for human consumption. They are usually made of polyethylene (plastic), steel, clay, ceramics and fiber glass. The need to investigate the changes in water quality during storage in different types of water storage tanks or vessels is very crucial in establishing which tank contributes to deterioration or improvement of stored water during storage. Two sources of potable water (tap water and borehole water) were stored in three water storage tanks for a period of six weeks. The tanks include black plastic tank, blue plastic tank and green plastic tank. The water quality parameters examined were Temperature, Taste, Odour, Colour, Turbidity, Conductivity, pH and Total Heterotrophic Bacteria (THB). However, all parameters listed above were analyzed at a sampling frequency of seven days interval. The results showed that among the different coloured storage tanks used, black plastic tank was the best in terms of preserving water quality. The range in the following examined toxic parameters Total heterotrophic bacteria in tap water stored in black plastic tank, green plastic tank and blue plastic tank were 2×102CFU/100mL – 106×102CFU/100mL, 2×102CFU/100mL – 116×102CFU/100mL and 2×102CFU/100mL – 118×102CFU/100mL respectively. On the other hand, the range for the said parameters for borehole water stored in black plastic tank, green plastic tank and blue plastic tank were respectively 6×102CFU/100mL – 100×102CFU/100mL, 6×102CFU/100mL – 104×102CFU/100mL and 6×102CFU/100mL – 108×102CFU/100mL. Also, findings from the study recommends that, the maximum retention period for storing tap water or borehole water in plastic tanks to be at most 3weeks. From this work, it was established that, black plastic materials should be considered first when selecting a container material for storing water in large capacity.

INTRODUCTION

Water is a chemical substance that is composed of two atoms of hydrogen and an atom of oxygen [1]. In typical usage, water refers to only its liquid form or state, but the substance also has a solid state known as ice, and a gaseous state called steam or water vapor. According to [2], water to be consumed by man/animals should fall within the range of certain limits set by World Health Organization (W.H.O.) often known as drinking water standards. Such water that is fit for human consumption is called potable water.

Water is readily available all over the world but only a very few proportion of it is potable or fit for human consumption [3]. Hence, there is the need of storing potable water in containers in order to ensure continuity in supply during interruption or disaster. Such containers used in storing water are called water storage reservoirs or tanks. Storage reservoirs are available in various forms based on the material of construction such as buckets, bottles, pots, GP tanks, over-head tanks, etc. A good storage reservoir should be able to maintain the quality (i.e. physio-chemical and bacteriological properties) of the water during period of storage or have minimal effect on the stored water when compared with the water source/W.H.O. standards, [4].

Plastic tanks are the most commonly used with its advantage being low cost, durability and of low maintenance [5]. While all the types of storage tanks mentioned above have all been considered useful in storing potable water by Standard Organization of Nigeria (SON), the fact remains that they come in variety of colours and the optimum retention periods for storing water in these tanks are not usually stated. The quality of potable water after storage in containers has always been questionable whether it improves or deteriorates. However, microbiological growth, temperature changes and quality deterioration has been noted and documented in certain storage tanks

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by several researchers. Hence, this research was aimed to determine whether plastic water storage container materials and colours actually have effect on the deterioration in quality of stored water.

The research was carried out to provide the best plastic storage container for the use of families and the general public to obtain potable water. It was also pointed out the retention time for the plastic storage container so that water users will know the maximum storage period for water consumption.

The study was limited to potable water pumped directly from borehole at the Bekaji Public Borehole of the Adamawa State Water Board, Yola. The water storage containers/tanks were limited to polyethylene plastic tanks. While the colours of the plastic tanks were limited to black, green and blue buckets that was used for the research.

MATERIALS AND METHODS

Study Area

The water source for this research was obtained at the Bekaji Public Borehole of the Adamawa State Water Board, Yola. The water source is located between longitude 12° 25' to 12°30' E and latitude 9° 12' to 9°17' N (GPS). The water source was chosen because of its close proximity to the Adamawa State Polytechnic Yola, where most of the water analysis was carried out and as the closest public borehole that serve a large community and is functional to date.

Sampling and Sampling Frequency

Water samples for analysis was obtained by opening the taps fitted in the storage vessels containing the water sources, and allowing the water to run for few minutes before collecting the water in sample bottles. Great care was taken during sampling to avoid contamination of the samples being collected as well as proper labeling of the sample bottles to avoid errors.

The frequency of sampling was seven (7) days interval (i.e weekly basis). This sampling frequency is in line with previous works carried out by [6] as well as [7].

Test Procedures

Before analyzing the water quality parameters, the three prototype containers were filled with water and test-run for one week and afterward, suitable modifications was made against leakages. Most parameters were analyzed as specified in the Standard Methods for Examination of Water and Waste water, these includes temperature, turbidity, odour, taste and colour. Others includes electrical conductivity, pH, and total heterotrophic bacteria.

Temperature

Temperature measurement were done with the use of a thermometer by extracting sample from the storage container into a test tube and inserting the thermometer immediately into the sample. The temperature reading were recorded at the point where the thermometric fluid in the thermometer remains constant.

Turbidity

This was determined with the use of HACH 2100N Turbidimeter made by HANNA, LTD, England. The device was standardized with respect to the standard cell in the device at 0.14 NTU (Naphelometric Turbidity Unit) and after which, the sample was well shaken and poured into another cell. A tissue paper was used in cleaning the walls of the cell in other to remove any finger print and it was thereafter replaced with the standard cell. The reading was recorded directly from the LCD in NTU.

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Odour

The determination of odour for each sample was carried out by giving the water sample to ten persons selected at random to perceive. The observations from these persons (i.e objectionable/unobjectionable) were the same in each of the water sample.

Taste

Just like odour, the determination of the taste of water stored in each of the tanks was carried out in a similar way like odour. That is, the water samples were given to ten different persons selected at random to taste. The comments from these persons (objectionable/unobjectionable) were also the same in each of the water sample. 3.3.3 Colour

pH

The pH of the water sample was measured with the aid of a HI83200 Multi-parameter Photometer made by HANNA, LTD, England. It was achieved by switching "ON" the apparatus and selecting the pH option among the other parameters. Next, the removal of the cuvette and rinsing it with distilled water and later with the sample to be determined. The sample was well shaken and 10 ml of it was measured into the cuvette and after which, it was covered with the cuvette cap. This was followed by cleaning the sides of the cuvette with a tissue paper in order to remove any finger print. The cuvette was then inserted properly into the apparatus until it read was zero, for the sake of standardizing the machine. The cuvette was removed and then ten drops of phenol red solution were added into the cuvette and well mixed with the sample in the cuvette. Again, the cuvette was cleaned with a tissue paper to remove any finger print on the sides. Finally, the cuvette was inserted into the device and the option "READ" was selected and the pH of the sample was displayed on the LCD.

Electrical conductivity

Measurement of electrical conductivity (EC) was carried out with the aid of HI9835 EC/TDS/NaCl meter, made by HANNA, LTD, England. It consists of an electrode and a meter. The device was switched "ON" after proper connection of the electrode to the meter and thereafter, the EC option was selected by continuous pressing of the key labeled "Range" until µS appeared on the LCD of the apparatus. The sample was thoroughly shaken and 50mL of it were measured into a test tube and afterward, the electrode was completely deep into the test tube containing the sample. It was ensured that no air bubbles adhere to the electrode. The electrical conductivity of the sample in µS/cm (micro Mohs per centimeter) was directly read from the LCD of the device.

Total heterotrophic bacteria

All the sample bottles used for bacteriological count were disinfected with methylated sprit while the mouth of the taps fitted in the storage reservoirs were flamed for about two minutes. The taps were opened and water was allowed to run for few minutes before filling the sample.

The method used in determining total bacteria was Total Viable Count (TVC) using nutrient agar as culture media. Prior to the test, the prepared nutrient agar as well as all apparatus such as petri-dish, pipettes, glass bent rod, etc. were sterilized in an autoclave marching. After sterilization, reasonable quantity of the culture media was poured into a sterilized petri-dish and 1 ml of the sample was transferred into the petri-dish using a sterilized pipette. This was followed by gradual spreading of the water sample in the petri-dish with a sterile glass bent rod and thereafter, it was turned up-side-down and then inoculated in an incubator for 24 hours. The bacteria colonies observed in the petri-dish after the inoculation was counted via a colony counter.

RESULTS AND DISCUSSIONS

The water quality parameters examined in each of the three water storage tanks or containers used after the research period elapsed (six weeks or 42 days) are presented in Tables 3.1 to 3.8.

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Temperature

Temperature measurements were taken at about 12 noon on each day of analysis. The temperatures of both water sources were found to be the same (25 oC) on the first day of the research.

Table 3.1 shows that both sources of water (tap water and borehole water) have no effect on water temperature during storage but rather, depend on the type and colour of material used in storage as well as the ambient temperature. This is because irrespective of the water source, similar reservoir materials as well as colours had the same mean temperature.

Table 3.1: Temperature variations in water stored in tanks during research period **(ºC).**

	BKPt	GRPt	BLPt	Mean	S.D	CV(%)	BKPb	GRPb	BLPb	Mean	S.D	CV(%)
I-Temp	25	25	25	25	0	0	25	25	25	25	0	0
Day 7	28	27.5	27.5	27.7	0.758	2.689	28	27.5	27.5	27.0	2.550	9.443
Day 14	29	28.5	28.5	28.7	1.025	3.485	29	28.5	28.5	28.7	3.353	11.939
Day 21	27.5	27.5	27.5	27.5	0.274	0.989	27.5	27.5	27.5	27.5	3.153	11.936
Day 28	28	28	28	28	0.548	1.985	28	28	28	28.0	3.141	11.928
Day 35	28	27.5	28	27.8	0.758	2.778	28	27.5	28	27.8	3.056	11.718
Day 42	28.5	29.5	28.5	28.8	0.758	2.588	28.5	28.5	28.5	28.5	3.327	12.024
Mean	27.7	27.6	27.6	-	-	-	27.7	27.5	27.5	-	-	-
S.D	1.286	1.376	1.205	-	-	-	1.286	1.225	1.190	-	-	-
CV (%)	4.644	4.985	4.366	-	-	-	4.644	4.454	4.328	-	-	-

Legend:

BKPb = Borehole water stored in a black plastic tank,

BKPt = Tap water stored in a black plastic tank,

BLPb = Borehole water stored in a blue plastic tank,

BLPt = Tap water stored in a blue plastic tank,

CV = Coefficient of variation,

GRPb = Borehole water stored in a green plastic tank,

GRPt = Tap water stored in a green plastic tank,

I-Tem= Initial temperature of water before storage,

S.D = Standard deviation,

Black Plastic (BKP) tanks for both water sources had slightly higher water temperatures than those of Blue Plastic (BLP) and Green Plastic (GRP) tanks. This could be because black bodies are good absorbers of heat, since their emissivity is one (1).

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Turbidity

The turbidity of tap water and borehole water obtained from the sources before storage were respectively 2.000 and 1.091NTU (Table 3.2). In other words, both water sources met the turbidity level set by W.H.O standard (5 NTU).

Table 3.2: Turbidity variations in water stored in tanks during research period (NTU).

	BKPt	GRPt	BLPt	Mean	S.D	CV (%)	BKPb	GRPb	BLPb	Mean	S.D	CV (%)
I-Conc	2	2	2	2	0	0	1.091	1.091	1.091	1.091	0	0
Day 7	2.08	2.07	2.21	2.12	5.879	143.0	0.214	0.209	0.211	0.211	2.359	183.1
Day 14	1.96	1.73	1.90	1.59	4.468	121.3	0.197	0.122	0.148	0.156	3.333	221.0
Day 21	1.83	1.56	1.65	1.68	3.361	123.9	0.303	0.317	0.11	0.243	0.591	80.8
Day 28	1.80	1.88	1.92	1.87	4.024	123.1	1.957	0.216	0.49	0.887	3.021	153.2
Day 35	1.95	1.81	1.93	1.89	4.885	138.6	0.259	0.263	0.661	0.394	3.784	178.8
Day 42	1.91	1.80	1.93	1.88	4.164	123.3	0.206	0.166	0.18	0.184	3.762	212.0
Mean	1.933	1.836	1.934	-	-	-	0.604	0.662	0.341	-	-	-
S.D	0.169	0.098	0.165	-	-	-	0.677	0.308	0.337	-	-	-
CV (%)	9.195	5.067	8.532	-	-	-	112.09	46.53	98.83	-	-	-

Legend:

BKPb = Borehole water stored in a black plastic tank,

BKPt = Tap water stored in a black plastic tank,

BLPb = Borehole water stored in a blue plastic tank,

BLPt = Tap water stored in a blue plastic tank,

CV = Coefficient of variation,

GRPb = Borehole water stored in a green plastic tank,

GRPt = Tap water stored in a green plastic tank,

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I-Conc = Initial concentration before storage,

S.D = Standard deviation,

Odour

The odours of both water sources (tap water and borehole water) before storage were unobjectionable. Table 3.3 also shows that amongst the three coloured storage tanks, the odour of water stored in the all the tanks started deterioration on the forty-second (42^{nd}) day as shown in Table 3.3. The unpleasant odour recorded in the tanks or containers during the storage period might have emanated from the dead cells (bacteria) that have occurred in the storage vessels during storage.

Table 3.3: Odour variations in water stored in tanks during research period**.**

	BKP_t	GRP_t	BLP_t	BKP_b	GRP_b	BLP_b
I-Obs	UO	UO	UO	UO	UO	UO
Day 7	UO	UO	UO	UO	UO	UO
Day 14	UO	UO	UO	UO	UO	UO
Day 21	UO	UO	UO	UO	UO	UO
Day 28	UO	UO	UO	UO	UO	UO
Day 35	UO	UO	UO	UO	UO	UO
Day 42	O	O	O	O	O	O

Legend:

BKP_b = Borehole water stored in a black plastic tank,

BKPt = Tap water stored in a black plastic tank,

BLP_b = Borehole water stored in a blue plastic tank,

BLPt = Tap water stored in a blue plastic tank,

CLP_b = Borehole water stored in a clay pot,

GRP_b = Borehole water stored in a green plastic tank,

GRPt = Tap water stored in a green plastic tank,

I-Obs = Initial observation before storage,

Taste

Just as in odour, the tastes of both water sources (tap water and borehole water) before storage were unobjectionable. Furthermore, the variation patterns of water taste in each of the storage tank or container were similar to those obtained in the odour of water corresponding to their respective storage vessels while the reverse was not the case as shown in Table 3.4. This confirm the assertion previously made that the primary source of the odour recorded in the water samples was as a result of the presence of organic matters such as dead cells or bacteria [8].

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Table 3.4: Taste variations in water stored in tanks during research period**.**

	BKP_t	GRP_t	BLP_t	BKP_b	GRP_b	BLP_b
I-Obs	UO	UO	UO	UO	UO	UO
Day 7	UO	UO	UO	UO	UO	UO
Day 14	UO	UO	UO	UO	UO	UO
Day 21	UO	UO	UO	UO	UO	UO
Day 28	UO	UO	UO	UO	UO	UO
Day 35	UO	UO	UO	UO	UO	UO
Day 42	O	O	O	O	O	O

Legend:

BKP_b = Borehole water stored in a black plastic tank,

BKPt = Tap water stored in a black plastic tank,

BLP_b = Borehole water stored in a blue plastic tank,

BLPt = Tap water stored in a blue plastic tank

GRP_b = Borehole water stored in a green plastic tank,

GRPt = Tap water stored in a green plastic tank,

I-Obs = Initial observation before storage,

O = Objectionable,

UO = Unobjectionable

Furthermore, Table 3.4 disclosed that all the water samples that recorded objectionable odour as shown in Table 3.4 during the research period equally records objectionable taste.

It should be noted that the reason why arithmetic mean, standard deviation and coefficients of variation were not determined in Tables 3.3 and 3.4 is because the results obtained are not numerical values.

Colour

Both water sources (tap water and borehole water) had same colour i.e 5TCU before storage which is well acceptable by W.H.O Standard. Table 3.5 showed that the water colour in all the reservoirs increased on the first week of research and thereafter, remained constant throughout the retention period.

It can be deduced from Table 3.5 that, all the storage vessels had a uniform colour variation during the period of experiment. Also, the maximum value recorded in these reservoirs was 10 TCU, which is much lesser than the permissible limit set by W.H.O Standard (15 TCU), indicating that the water stored in these vessels are okay in terms of colouration.

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Table 3.5: Colour variations in water stored in tanks during research period (TCU).

	BKPt	GRPt	BLPt	Mean	S.D	CV (%)	BKPb	GRPb	BLPb	Mean	S.D	CV (%)
I-Colour	5	5	5	5	0	0	5	5	5	5	0	0
Day 7	10	10	10	10	4.08	34.99	10	10	10	10	4.08	34.99
Day 14	10	10	10	10	4.08	34.99	10	10	10	10	4.08	34.99
Day 21	10	10	10	10	4.08	34.99	10	10	10	10	4.08	34.99
Day 28	10	10	10	10	4.08	34.99	10	10	10	10	4.08	34.99
Day 35	10	10	10	10	4.08	34.99	10	10	10	10	4.08	34.99
Day 42	10	10	10	10	4.08	34.99	10	10	10	10	4.08	34.99
Mean	10	10	10	-	-	-	9.3	9.3	9.3	-	-	-
S.D	1.90	1.90	1.90	-	-	-	1.9	1.9	1.9	-	-	-
CV (%)	20.40	20.40	20.40	-	-	-	20.40	20.40	20.40	-	-	-

Legend:

BKP_b = Borehole water stored in a black plastic tank,

BKPt = Tap water stored in a black plastic tank

BLP_b = Borehole water stored in a blue plastic tank,

BLPt = Tap water stored in a blue plastic tank,

CV = Coefficient of variation,

GRP_b = Borehole water stored in a green plastic tank,

GRPt = Tap water stored in a green plastic tank,

I-Colour = Initial colour of water before storage,

S.D = Standard deviation,

Electrical Conductivity

Before storage, the initial E.C value of tap water was recorded to be 118.99µS/cm while that of borehole water was as high as 707.02µS/cm. The high value of E.C recorded in the borehole water could be attributed to the geology of the aquifer surrounding the borehole [9].

The results shown in Table 3.6 suggest that the E.C values of the borehole water stored in all the tanks/containers respond to changes more than those of the tap water. It is important to note that irrespective of the different variations displayed by the different water sources, both water sources recorded an improvement in E.C

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concentration in the first week and also, all the recorded values were in line with W.H.O standard since the maximum permissible limit set by W.H.O is 1000µS/cm.

Table 3.6: Electrical conductivity variations in water stored in tanks during research period (µS/cm)

	BKPt	GRPt	BLPt	Mean	S.D	CV(%)	BKPb	GRPb	BLPb	Mean	S.D	CV(%)
I-EC	118.99	118.99	118.99	118.99	0	0	707.02	707.02	707.02	707.02	0	0
Day 7	91.01	83.95	90.96	88.64	14.99	15.12	637.60	616.05	644.03	632.56	14.39	2.26
Day 14	108.49	118.98	125.96	117.80	10.7	8.95	734.96	728.00	735.02	732.66	33.84	4.78
Day 21	136.45	87.53	97.95	107.31	20.12	17.60	706.97	717.53	734.99	720.16	46.10	6.54
Day 28	112.04	122.54	98.02	110.87	17.39	15.69	714.04	735.01	735.04	728.03	14.97	2.06
Day 35	105.04	112.02	91	102.69	13.46	12.82	637.50	616.08	644.02	632.53	14.00	2.20
Day 42	108.52	119	126	117.84	10.69	8.94	735.03	728.01	735.03	732.69	33.84	4.78
Mean	111.51	109	106.98	-	-	-	696.16	692.53	705.02	-	-	-
S.D	13.90	16.23	16.02	-	-	-	41.715	52.994	42.905	-	-	-
CV(%)	12.46	14.89	14.98	-	-	-	5.992	7.652	6.086	-	-	-

Legend

BKP_b = Borehole water stored in a black plastic tank,

BKPt = Tap water stored in a black plastic tank,

BLP_b = Borehole water stored in a blue plastic tank,

BLPt = Tap water stored in a blue plastic tank,

CV = Coefficient of variation,

GRP_b = Borehole water stored in a green plastic tank,

GRPt = Tap water stored in a green plastic tank,

I-EC = Initial Electrical Conductivity of water before storage,

S.D = Standard deviation,

pH

The initial pH values for both water sources were 6.6 and 7.0 for tap water and borehole water respectively which is acceptable by W.H.O standard. However, during the storage period, there were instances in which the pH values recorded were outside the range of the permissible limits set by W.H.O (6.5-8.5). This deviation in pH from the permissible limits were more noticeable in water stored in green plastic tank (GRPt) and blue plastic tank (BLPt) respectively on the 14th day as can be observed in Table 3.7.

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It is obvious in Table 3.7 that, there was a significant drop in the pH during the thirty-fifth (35^{th}) and forty-second (42^{nd}) day of retention. This might be as a result of the high secretion of acid by dead bacteria [10] during the death phase which occurred this period (35^{th} – 42^{nd} week).

Table 3.7: pH variations in water stored in tanks or containers during research period**.**

	BKPt	GRPt	BLPt	Mean	S.D	CV (%)	BKPb	GRPb	BLPb	Mean	S.D	CV (%)
I-pH	6.6	6.6	6.6	6.6	0	0	7.00	7	7	7.00	0	0
Day 7	7.0	7.5	7.1	7.20	0.225	3.14	7.20	7.30	7.4	7.30	0.51	6.84
Day 14	8.1	8.8	8.7	8.53	0.172	2.12	7.10	7.60	7.8	7.63	0.58	7.62
Day 21	7.7	8	7.6	7.77	0.266	3.48	7.00	7.20	7.6	7.27	0.45	6.08
Day 28	7.5	7.7	7.6	7.60	0.344	4.63	6.90	7.30	7.6	7.27	0.39	5.43
Day 35	6.0	6.4	6.7	6.37	0.320	4.95	6.30	6.70	6.6	6.53	0.14	2.10
Day 42	6.0	6.7	6.6	6.43	0.601	9.37	6.40	6.30	6.6	6.43	0.19	2.95
Mean	7.0	7.3	7.3	-	-	-	6.8	7.1	7.2	-	-	-
S.D	0.55	0.83	0.62	-	-	-	0.32	0.44	0.5	-	-	-
CV(%)	7.53	11.86	8.61	-	-	-	4.638	6.197	6.944	-	-	-

Legend:

BKP_b = Borehole water stored in a black plastic tank,

BKPt = Tap water stored in a black plastic tank,

BLP_b = Borehole water stored in a blue plastic tank,

BLPt = Tap water stored in a blue plastic tank,

CV = Coefficient of variation,

GRP_b = Borehole water stored in a green plastic tank,

GRPt = Tap water stored in a green plastic tank,

I-pH = Initial pH value of water before storage,

S.D = Standard deviation,

Total Heterotrophic Bacteria

Both water sources (tap water and borehole water) used for the research were not completely free from total bacteria before the storage, as they were respectively containing 2 and 6 CFU/mL of total bacteria respectively. This signifies that the sources where these water samples were drawn, met the requirement set by W.H.O Standard for Drinking water Quality in terms of total bacteria (100CFU/mL or 10^4 CFU/100mL) as at the time the water samples were collected (25^{th} August, 2024).

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The growth of bacteria in the storage tanks suggests that either; the few bacteria present in the water samples prior to storage were spore-forming bacteria that might have shield themselves against the un-conducive environment caused by residual chlorine, or bacteria from the surrounding environment might have found their way into the stored water in the vessels.

Based on the information displayed in Table 3.8, it can be concluded that; total bacteria growth rate in water stored in green and blue tanks were more than those recorded in black tanks.

Table 3.8: Total Heterotrophic Bacteria (THB) variations in water stored in tanks during research period ($\times 10^2$CFU/100mL).

	BKPt	GRPt	BLPt	Mean	S.D	CV (%)	BKPb	GRPb	BLPb	Mean	S.D	CV (%)
I-Conc	2	2	2	2	0	0	6	6	6	6	0	0
Day 7	11	16	33	20	8	36	12	15	15	14	12	51
Day 14	19	27	29	25	26	52	23	34	41	33	24	45
Day 21	58	63	51	57	33	40	51	67	63	60	31	36
Day 28	66	80	76	74	23	26	85	96	94	92	36	30
Day 35	106	116	114	112	17	14	100	104	108	104	15	13
Day 42	104	112	118	111	16	16	94	96	100	97	9	8
Mean	52	59	60	_	_	_	71	60	60	_	_	_
S.D	48	42	37	_	_	_	38	41	40	_	_	_
CV (%)	61	74	67	_	_	_	54	68	67	_	_	_

Legend:

BKPb = Borehole water stored in a black plastic tank,

BKPt = Tap water stored in a black plastic tank,

BLPb = Borehole water stored in a blue plastic tank,

BLPt = Tap water stored in a blue plastic tank,

CV = Coefficient of variation,

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GRPb = Borehole water stored in a green plastic tank,

GRPt = Tap water stored in a green plastic tank,

I-Conc = Initial concentration before storage,

S.D = Standard deviation

Figure 3.1 shows the relationship between the three colored water storage tanks from tap and total heterotrophic bacteria with time in days. The graph shows that the black storage tank was having less concentration of THB of 11X10^2CFU/100mL after seven days, when compared with the green and blue tanks with THB concentration of 16X10^2CFU/100mL and 33X10^2CFU/100mL respectively. The graph also shows that after an interval of each seven days and for complete 42 days of water storage in the three colored tanks, the concentration of THB was less in the black plastic tank than the other two tanks except on the 21st day that the blue tank was having less concentration THB than the black tank.

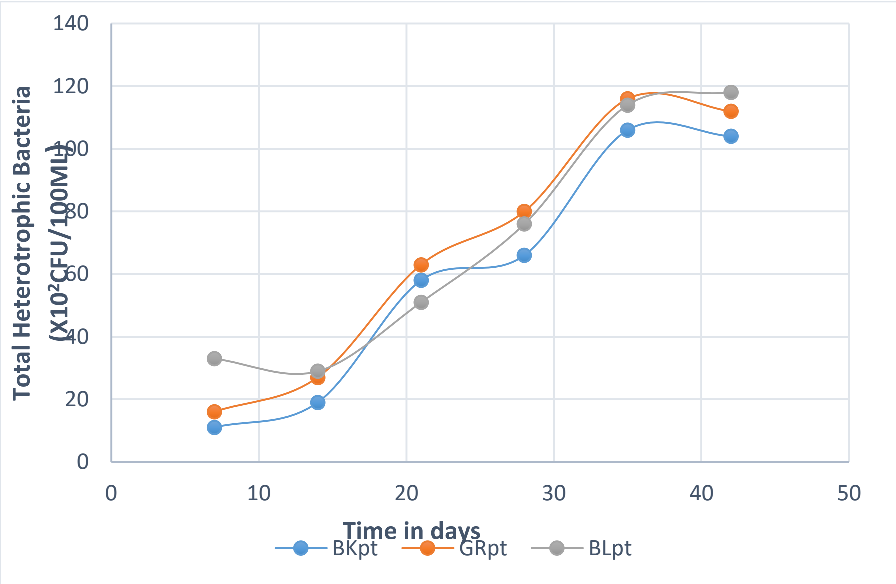

Figure 3.1: Relationship between three colored water storage tanks from tap and THB with time

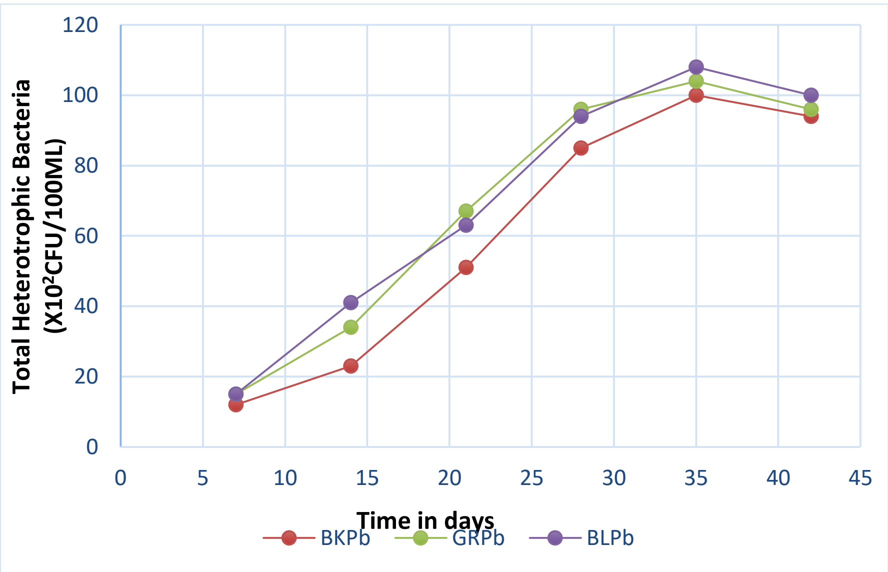

Figure 3.2: Relationship between three colored water storage tanks from borehole and THB with time

Figure 3.2 shows the relationship between the three colored water storage tanks from borehole and total heterotrophic bacteria with time in days. The graph shows that the black storage tank was having less

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concentration of THB of $12X10^2$CFU/100mL after seven days, when compared with the green and blue tanks with THB concentration of $15X10^2$CFU/100mL and $15X10^2$CFU/100mL respectively. The graph also shows that after an interval of each seven days and for complete 42 days of water storage in the three colored tanks, the concentration of THB was less in the black plastic tank than the other two tanks.

Determination of Best Storage Tank in Terms of Water Quality Preservation

The container material and colour that best preserved water quality during storage was determined by calculating the coefficients of weekly variation of the examined parameters (Table 3.1 to 3.8). Thereafter, the minimum values (coefficients of weekly variation) of these parameters in each of the storage materials were noted as shown in Table 3.9 and 3.10.

Since Table 3.9 and 3.10 showed that the highest percentage of minimum coefficients of variation, for the weekly changes of parameters is 2, which corresponds to tap water and bore hole water stored in black plastic tanks (i.e BKP_t and BKP_b), it simply suggests that black plastic tank best preserved the water quality parameters among the other water storage tanks used.

Table 3.9: Number of parameters having minimum coefficients of weekly variations in stored tap water.

Storage tank	Parameter	No. of Parameters
BKP_t	Total Heterotrophic Bacteria (THB) and pH	2
GRP_t	Turbidity	1
BLP_t	Temperature	1

Legend:

BKP_t = Tap water stored in a black plastic tank,

BLP_t = Tap water stored in a blue plastic tank,

GRP_t = Tap water stored in a green plastic tank,

Table 3.10: Number of parameters having minimum coefficients of weekly variations in stored borehole water

Storage tank	Parameter	No. of Parameters
BKP_b	Total Heterotrophic Bacteria (THB) and pH	2
GRP_b	Turbidity	1
BLP_b	Temperature	1

Legend:

BKPb = Borehole water stored in a black plastic tank,

BLPb = Borehole water stored in a blue plastic tank,

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GRPb = Borehole water stored in a green plastic tank,

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