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International Digital Organization for Scientific Research
IDOSR JOURNAL OF APPLIED SCIENCES 1(1) 1-6, 2016.

EFFECT OF PLASTIC ON THE PHYSICO-CHEMICAL ANALYSIS OF SOME BOTTLED WATER SOLD IN OBA, IDEMILI SOUTH LOCAL GOVERNMENT AREA, ANAMBRA STATE AND IT'S ENVIRONMENTS.

[1]Udeozo, I. P., [2]Ikezu, U.M. and [1]Anachunam, A.E.

[1]Department of Chemistry, Tansian University Umunya, Anambra State, Nigeria.
[2]Department of Chemistry, Imo State University Owerri, Imo State, Nigeria.

ABSTRACT

Water is essential to sustain life. Many potential hazardous situations can arise from consumption or use of contaminated water. Two different bottled water samples commonly sold in Oba and its environments were analyzed both as fresh and after three months storage at room temperature for each of the samples. Their physicochemical and trace heavy metal constituents were analyzed with a view of determining their portability and effects of plastics (container) after three months of storage. The results indicated that the four water samples were within the Nigerian Industrial Standard permissible range except free chloride for sample B after three months of storage which might be very dangerous to human health. Storing of water in a plastic container for three months and above affects the quality of water either in the increasing or decreasing order. This was depicted in values of the following parameters; conductivity, total alkalinity, total suspended solids, total solids, total dissolve solids, methyl alkalinity, calcium, phosphate, nitrate, zinc and free chloride. The variation of these parameters against recommended standard poses health implications which ranges from cancer, neuro-degenarative disorder, cyanosis, asphyxia, fluorosis, skeletal tissue, kidney, gastrointestinal and central nervous system disorder. Therefore, the storage of drinking water should be checked because it is as important as checking the portability of water.

Key words: Plastics, physicochemical analysis, polyethylene and bottled water.

INTRODUCTION

Water is the most abundant compound on earth's surface covering about 70% of the planet and making up to 55 - 78% of the human body. Water is of paramount important to both plants and animals, no life can exist without water. It is therefore necessary that water required for drinking and other house use should be of good quality void of harmful contaminants [1].

Water is often bottled in PET or PETE bottles (polyethylene terephthalate) which may or may not leach DEHA (Di(2-ethylhexyl) adipate or Bis(2-ethylhexyl) hexanedioate) , a known carcinogen, into the water. Experts agree that we should not reuse all plastic because it has been exposed to bacterial and contain Bisphenol which is suspected of causing neurological and behavioral problems in fetuses and children which mimics the female hormone estrogen. This has a detrimental effect on the female reproductive system, immune system in adults and is particularly devastating to babies and young children. Cancer of the brain, breast and prostate are also included in its detrimental effect [2]. It is better to use a reusable water bottle and fill it with your own filtered water from home and keep those single use bottles out of the land fill. Unfortunately those fabulous colorful hard plastic lexan bottles made with poly carbonate plastic and identified by the #7 re-cycling sysmbol may each have BPA (Bisphenol A) which is an xenoestrogen [3]. The human exposure to BPA is widespread and very detrimental. The 2003-2004 National Health and Nutrition Examination Survey (NHANES III) conducted by the Centers for Disease Control and Prevention (CDC) found detectable levels of BPA in 93% of 2517 urine samples from people six years and older [4].

This research work aims at studying the portability and effect of plastic on the physicochemical properties of the two commonly sold bottled water in Oba and its environment. Oba is situated at Idemili South Local Government Area of Anambra State.

EXPERIMENTAL

Water samples (A_1, A_2, B_1 and B_2) were sold in Oba metropolis. There are two different water used, each containing fresh and stored samples. A_1 and A_2 are the same water type, freshly supplied sample (A_1) and three months stored sample (A_2) likewise, B_1(freshly supplied sample B_1) and B_2(three months stored sample B). The parameters analyzed include; colour, odour, taste, temperature, turbidity, chloride, free chlorine, phosphate, fluoride, copper, iron, nitrate, nitrite, zinc, sulphate, lead, magnesium, calcium, conductivity, pH, total hardness, total alkalinity, total dissolve solid (TDS), total suspended solid (TSS) and methyl alkalinity. These were determined according to the recommended method [5, 6].

Table 1: Physicochemical Characteristics of Four Water Samples

Parameter	Unit	Sample A_1	Sample A_2	Sample B_1	Sample B_2	Maximum Permissible Limit
Colour		Colourless	Colourless	Colourless	Colourless	
Odour		Odourless	Odourless	Odourless	Odourless	
Taste		Tasteless	Tasteless	Tasteless	Tasteless	
Teperature	Celcius	25.0°C	25.0°C	25.0°C	25.0°C	Ambient
Total suspended solids (TSS)	Mg/l	0.003	0.00	0.006	0.00	2.5
Total solids	Mg/l	41.003	37.00	42.004	35.00	500.00
Methly alkalinity	Mg/l	59.00	40.00	53.00	39.00	100.00
Phenolpthalein	Mg/l	0.00	0.00	0.00	0.00	100.00
Total dissolved solids (TDS)	Mg/l	41.00	37.00	44.00	40.00	500.00
Total hardness (as $CaCO_3$)	Mg/l	39.00	39.00	42.00	42.00	100.00
Total alkalinity	Mg/l	59.00	40.00	53.00	38.00	100.00
Conductivity	uS/cm	93.00	83.00	98.00	88.0	1000.00
pH	Mg/l	7.80	7.80	8.50	8.50	6.5-8.5
Sulphate	Mg/l	0.00	0.00	0.00	0.00	100.00
Nitrite	Mg/l	0.00	0.00	0.00	0.00	0.1
Nitrate	Mg/l	0.00	0.20	0.00	0.30	10.00
Phosphate	Mg/l	0.70	0.90	0.60	0.70	-
Chloride	Mg/l	10.00	10.00	11.00	11.00	100.00
Free chloride	Mg/l	0.0	0.0	0.0	0.60	0.30
Copper	Mg/l	0.35	0.35	0.37	0.36	1.00
Iron	Mg/l	0.03	0.03	0.03	0.03	0.30
Magnesium	Mg/l	5.00	5.00	5.00	5.00	5.00
Calcium	Mg/l	61.00	59.00	59.00	56.00	75.00
Zinc	Mg/l	0.22	0.23	0.22	0.23	5.00
Lead	Mg/l	0.00	0.00	0.00	0.00	0.01

RESULTS AND DISCUSSION

Table 1 summarized the results for all the parameters determined in comparison with the Nigerian Industrial Standard (NIS 306:2008) permissible range. The table showed that the physical parameters; odour, taste, temperature, colour and turbidity of the four samples were odourless,

tasteless, 25°C, colourless and clear respectively. Also pH values vary from 7.80 to 8.50 and are within normal range. The results of the chemical parameters indicated that the four water samples respectively depicted low level of chloride (10mg/l, 10mg/l, 11mg/l and 11mg/l) and nitrate (0mg/l, 0.2mg/l, 0mg/l and 0.3mg/l) when compared to the standard given for portable water (NIS, 2008) [7]. The calcium and magnesium content of the four samples were within the maximum permissible level given. As a result, there depicts low possibility of the water being hard because calcium or magnesium is the major constituent of hard water. The normal values of the total hardness in the samples which vary from 39.00 to 42.00mg/l confirmed the above observations. Alkalinity of water is the capacity of water to neutralize a strong acid and is normally due to the presence of bicarbonate, carbonate and hydroxide compounds of calcium, sodium and potassium [8]. Alkalinity value ranges from 38.00 to 59.00 mg/l which were lower than the permissible limit. The level of the total dissolved solids in the samples was very low which indicated that there were very few ions in the water samples. Also Conductivity which indicated the amount of total dissolved ions [9] depicted value range from 83.00 to 93.00 uS/cm and are lower than the permissible limit. Sulphates which are responsible for corrosion problems and the heavy metals such as iron, zinc and lead were within the permissible limit. The results analysis showed that the four water samples were portable.

Effect of container (plastic) after three months storage was observed by comparing the fresh and stored water samples result, the result showed no effects in some parameters which include; colour, odour, taste, temperature, turbidity, chlorine, iron, magnesium, nitrate, pH total hardness, sulphate and lead. There also depicted decrease effect in some of the four samples (A_1-A_2, B_1-B_2) which was reflected in the following parameters; conductivity (93-83 uS/cm, 98-88 uS/cm), total alkalinity (59-40 mg/l, 53-38 mg/l), total suspended solids (0.003-0 mg/l, 0.006-0 mg/l), total solids (41.003-37 mg/l, 42.004-35 mg/l), total dissolved solids (41.0-37 mg/l, 44.0-40 mg/l), methyl alkalinity (59-40 mg/l, 53-39 mg/l), copper (0.35-0.35 mg/l, 0-0.36 mg/l) and calcium (61-59 mg/l, 59-56 mg/l). There also showed an increase effect on phosphate (0.7-0.9 mg/l, 0.6-0.7 mg/l), free chlorine (0.0-0.0 mg/l, 0.0-0.60 mg/l), nitrate (0.0-0.2 mg/l, 0.0-0.3 mg/l) and zinc (0.22-0.23 mg/l, 0.22-0.23 mg/l). The results showed variation in most of the analyzed parameters though still within the maximum permissible limit except free chloride for sample B which might be very dangerous to human health. The variation of these parameters

against recommended standard poses health implications which ranges from cancer, neuro-degenarative disorder, cyanosis, asphyxia, fluorosis, skeletal tissue, kidney, gastrointestinal and central nervous system disorder.

CONCLUSION

The results of analysis performed on the quality characteristics of two commonly bottled water sold in Oba, Idemili South Local Government Area and its environment indicated that the water samples were within the Nigerian Industrial Standard (NIS 306:2008) permissible range.

Storing of water in a plastic container for three months and above affects the quality of water either in the increasing or decreasing order. This was depicted in values of the following parameters; conductivity, total alkalinity, total suspended solids, total solids, total dissolve solids, methyl alkalinity, calcium, phosphate, nitrate, zinc and free chloride.

Sample B after three months storage (B_2) showed free chloride value (0.60mg/l) above the maximum permissible level (0.30mg/l) which might pose some health implication to human life. Therefore, the storage of drinking water should be checked because it is as important as checking the portability of water.

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