QUALITY ASSESSMENT OF WATER SUPPLY IN MURTALA MUHAMMED INTERNATIONAL AIRPORT, LAGOS, NIGERIA.

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ABSTRACT

This research assessed the quality of water and by implication the functionality of the treatment plant units in Murtala Mohammed International Airport, Ikeja, Nigeria. Raw water samples were collected at eight different points from the plant to the end users for three consecutive months. Physico-chemical properties of collected samples were analysed using standard methods and compared with the World Health Organization (WHO) standard. The values of properties obtained for plant raw and treated water ranged from .19 - 7.4, 24.60 - 26.00°C, 3.79- 0.00 NTU, 33.30-16.70Hazen,0.17 -0.00mg/l and 36.7 -44.30 ppm, for pH, temperature, turbidity, hazencolour, iron content, total dissolved solid respectively. While the values obtained for total hardness, calcium hardness, magnesium hardness, residue chlorine, odour, electrical conductivity, nitrate, BOD and Dissolved Oxygen, were 7.3 -5.7mg/l,3.7 -3.00 mg/l3.7-2.7mg/l,0.00 -0.00mg/l,46– 72µs/c, 0.59 - 0.56 mg/l, 3.23 - 4.17mg/l and 2.66 - 2.75 mg/l respectively. The values of parameters for the treated water were in all cases always better than those obtained for the raw water. All the physico-chemical properties obtained for the treatment line were within WHO standard except for raw water pH whose value was lower than the recommended WHO value. This observation showed that the treatment units improved the quality of the treated water and it is safe to use as potable water.

Keywords: Water quality, Water treatment plant, WHO standard,

1 INTRODUCTION

Water quality refers to the chemical, physical, biological and microbiological properties of water (Bartram and Ballance, 1996). There is a wide variability in these properties throughout the world. Themeasureof the water condition is relative to the requirement of one or more biotic species and to any human need or purpose (Cheremisinoff, 2002). Polluting activities, such as intentional or accidental discharge of domestic, industrial, urban and other wastewaters into the watercourse; and the spreading of chemicals on agricultural land in the drainage basin affect the water qualities. Considering the level of industrial growth in Lagos, Nigeria in which wastes from paint, textile, polymer and automobile industries among others are discharged directly to the environment which could contaminate both surface and groundwater.

Drinking water quality standard describes the quality parameter set for portable water. Therefore, any drinking water pumped to the public must meet WHO standards (Onweluzo and Akuaghazie 2010, Badejo *et. al*. 2015).The Murtala Muhammed International Airport (MMA), Lagos water scheme is the main source of municipal water supply to the workers in the airport and environment. The scheme was commissioned in the year 1978. The source of water is boreholes. To achieve WHO "standard" raw water in MMA is subjected to purification processes such as aeration, sedimentation, coagulation, flocculation, filtration and disinfection. Considering the length of time (40 years) that the MMA water scheme has been commissioned, there is a need to assess the quality of the water from each of the purification units in order to determine their effectiveness.

2 MATERIALS AND METHODS

2.1 Description of study area.

The study was conducted at Murtala Muhammed International Airport, Lagos. It is located in the south western geopolitical zone of Nigeria within Latitude: 6° 35' 00" N and Longitude: 3° 45' 00" E, bounded by Ogun State, in the west, shares boundaries with the Republic of Benin and its southern borders is bounded by the Atlantic Ocean.

Twenty two (22%) of its land area (3,577km^2) are lagoon and creeks.

2.2 Water Treatment Steps in MMA Treatment Plant

MMA water treatment plant includes: the source (boreholes) (BO), Aeration (AE), Sedimentation (SE) and Filtration (FI) and distribution lines. The design capacity of the scheme is 200m^3/hr. The scheme has an intake structure (Plate 1) with four pumps each with capacity of 90m^3/hr, at 100mhead, powered by 45kw generator. Inlet pipe to the aerator is 300 mm diameter (Plate 1a).The aerator is a cascade type with a series of steps which water flows over, similar to flowing stream (Plate 1b). The aerator brings water and air into close contact in order to remove dissolved gases such as CO_2 and to oxidize hydrogen sulphide, Volatile Organic Chemicals (VOC) and dissolved metals such as iron; this is the first major process in the treatment plant. Two sedimentation tanks made of reinforced concrete (Plate 1c) of 300,000 litres capacity each were used. The filtration system is a circular shape filled with filer media ranging from coarse to fine sand. The clear water reservoirmade of reinforced concrete is of 1000,000litrescapacity, equipped with inlet, wash out and outlet pipes of 200mm diameter. The pipe distribution network of the corporation has different pipe sizes and types ranging from 200 – 100, 65 – 60, and 60 – 35 mm for steel, PVC and galvanized iron pipe respectively.

a b c

Plate 1: A section of the (a) source of water (boreholes) with a common header channeled into the aerator. (b) Aeration tank (c) Sedimentation tank

2.3 Water distribution network

This is the network that delivers sufficient water quantity and quality from the source to the end users (Fig. 2). This is achieved by the use of pumps (mechanical and electrical), storage reservoirs and service pipes.

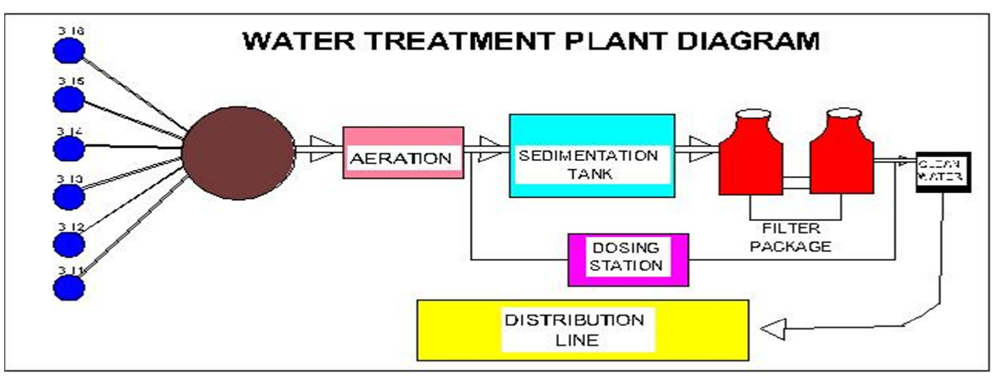

Fig. 2: Water Distribution Network of MMA Treatment Plant.

2.4 Laboratory Experiment

Water samples were taken for duration of three months at eight different points within the airport vicinity.

2.4.1 Sampling procedure

Apparatus such as burettes, pipettes, measuring cylinders, volumetric flasks were washed with non-odorous soap and acid cleaning solution and dried in oven at regulated temperature before use. The sample plastic bottles (250 ml and 750ml) were rinsed with distilled water first and later rinsed with the water sample from the point of collection. The sample details were adequately described and the sterile plastic sample bottles were properly labeled to avoid error. Water samples were taken from raw source, aerator, sedimentation tank, and filter and at four other different points in the airport environment. Samples were analyzed in the laboratory for the major ions using standard methods and physico-chemical parameters such as temperature and pH were determined with thermometer and pocket digital pH meter while other parameters such as DO, BOD, TDS, hardness, chlorine residue and Nitrate were determined in the laboratory using titration method and Atomic Absorption spectrophotometer.

3 RESULTS AND DISCUSSION

Table 1 shows the results of the experiment, pH level ranged from 6.19 - 7.37 for the water sample tested. pH value of 6.19 for raw water was not within the recommended 6.5 – 8.5 value of WHO for portable water. pH value progressively improved as the water passes through aeration, sedimentation and filtration, which shows their effectiveness. In addition, the water distributed to the various outlet also fell within the WHO recommended value as far as pH value is concerned. Acidic water with a pH less than 5.1 may increase problems related to chronic or mild acidosis while water with a pH over 9.0 may result in problems related to chronic or mild alkalosis as reported by Fasae and Omolaja (2014).

The temperature of the water samples from each unit ranged between 24.6 and 27.1^{o}C and is relatively higher than WHO value of 25, except for raw water, this might be due to the effect of tropical temperature which is normally higher. However, these values were much lower an indication of no magnetic heating as suggested at other volcanic prone areas where the temperature is always much more higher (Ewusi,*et al.* 2013) The colour (33.30 Hazen unit) and rusty odourin raw water that was higher than the recommended WHO value (15 Hazen unit)were effectively brought within the WHO recommended value by the treatment unit. Colour and odour are part of the organoleptic property of water sample they are most significant indication of presence of pollutants such as pathogens, nutrients and chemicals among others (Fasae and Omolaja, 2014). The turbidity, iron, TDS, total hardness, Ca hardness as well as Mg hardness and residua chlorine, EC, nitrate DO content of both the raw water and the treated were within the recommended WHO value. The lower values of the DO could be due to higher temperature as the DO decreased with increase in water temperature.

Table 4: Mean value of data collected from August – October 2015.

Parameters	RW	AE	SE	FI	CW	IT	PB	MMA2	WHO*
pH	6.19	7.15	7.3	7.4	7.37	7.01	7.37	6.8	**6.5-8.5**
Temp.^{o}C	24.6	26.3	26.2	26	26	27.1	26.3	27.1	**25**
Turbidity NTU	3.79	0.74	2.74	0.00	0.00	0.00	0.00	1.12	**≤5**
Colour(Hazen unit)	33.3	16.7	26.7	16.7	13.3	11.7	8.3	13.3	**15**
Fe(mg/l)	0.17	0.05	0.05	0.00	0.00	0.00	0.00	0.00	**0.3**
TDS(ppm)	36.7	40.7	41.7	44.3	47	37	32	44	**<600**
Total hardness (mg/l)	7.3	12.7	4.7	5.7	6.3	14.3	7.7	6	**500**
Ca hardness (mg/l)	3.7	3.3	3.3	3.0	3.0	10	4.3	4.3	**0-75**
Mg hardness (mg/l)	3.7	2.3	1.3	2.7	3.3	4.3	3.3	1.7	**≤30**
Residue chlorine (mg/l)	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	**0.2-0.25**
Odour	Rusty	Rusty	Rusty	Rusty	Cl	Cl	Cl	Cl	**Cl**
EC(μs/cm)	46.3	52	77.3	72	69	67.3	65.3	72.3	**180**
Nitrate (mg/l)	0.59	0.29	0.55	0.56	0.46	0.52	0.55	0.99	**50**
BOD (mg/l)	3.23	3.19	3.79	4.17	3.46	3.6	4.09	3.4	
DO2(mg/l)	2.66	2.47	2.5	2.75	3.42	2.8	3.9	2.6	73

***WHO, 2004**

Conclusions

The value of various parameters for raw water being an underground water were within the WHO standards for portable water. However, there was a better improvement after treatment. Physico-chemical and biological parameters collected and analysed in comparison to WHO standards indicated that the water produced at the treatment plant are within a save values.

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