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Determination of the Concentration of Dissolved Oxygen in Water Samples from Pankshin Town to Monitor Water Pollution.

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Abstract

Concentration of Dissolved Oxygen in various water sample from three different water sources in Pankshin were determined to index the level of water pollution. The temperature of the water samples ranged between 24-30°c. The P^H were within the range of 5.33-7.00. The amount of suspended solid (SS) and dissolved solid (DS) ranged from 0.03 $x10^3$-0.15$x10^3$ ppm and 0.05-0.10ppm respectively. Conductivity levels were in the range of 92-80µscm^{-1}. Dissolved oxygen (Do) had concentration range of 9.2-9.7 ppm. Of all the samples, the dissolved oxygen levels are within the acceptable limits of WHO. Pollution risk is therefore minimal.

Key words: Dissolved Oxygen, Conductivity levels, pollution.

1.0 Introduction

The use of water in domestic, agro and industrial cycles need no emphasis. A basic fact exist that water obtained from the environment sustains the living organisms.

Like terrestrial animals, fish and other aquatic organisms need oxygen to live. Dissolved oxygen has microscopic bubbles of oxygen mixed in water and occurs between the water molecules (Mueller and Helsel 2011). The oxygen enters the water by absorption directly from the atmosphere or by aquatic plants and algae photosynthesis and it is removed from the water by respiration and decomposition of organic or waste matter.

When dissolved oxygen concentration drops, major changes in the types and amounts of aquatic organism found in the water can occur (Murphy; 2005). Species that need high concentrations of dissolved oxygen such as mayfly nymphs, stonefly nymph, caddisfly harvae, pike, trout and bass will move out or die. They will be replaced by organisms such as sledge worms, blackfly larvae and leeches which can tolerate lower dissolved oxygen concentration (Michauel, 1991).

Water that has low dissolved oxygen sometimes smells badly because of various pollutants in the water and waste product produced by organism that live in such low oxygen environment. Very low dissolved oxygen concentration can result in mobilization of trace metals (Hem, 2001). Fish that is under stress as a result of low oxygen levels in the water is more susceptible to poisoning by insecticides or heavy metals (Cadato, 1990). Dissolved oxygen is therefore one of the best indicators of the health of a particular water ecosystem and a very important indicator of a water body's ability to support aquatic life.

Aim of the research work

The research work is aimed at determining, understanding and to generate a profile of pollution of the environment of the aquatic organism through determination of the total dissolved oxygen in the aquatic environment.

2.0 Methodology

2.1 Sample Collection, Preparation and Analysis

The winkler modified analysis (APHA, 1991) was used.

Three different aggregate samples of water were collected from different sources in October, 2012 at about 12.00 noon in Pankshin town. 400cm^3 capacity Evan plastic bottles were completely filled with the liquid and no air was trapped under the stopper. The following analyses were carried out on the samples.

2.2 Temperature determination

The temperature of the water samples were measured inlab to avoid change of temperature with time using a thermometer.

2.3 P^H determination.

The P^H of the samples was also determined on the spot using the electronic P^H meter with probe.

2.4 Suspended Solids (SS) determination.

50cm^3 of the water samples from each of the samples was filtered using a pre – weighed filter paper. The residue were allowed to dry and reweighed until a constant weight was obtained. This gave the amount of the suspended solids.

2.5 Dissolved Solids (DS) determination

The filtrates from above were separately evaporated in a pre-weighed evaporating dish to dryness to a constant weight.

2.6 Determination of Conductivity

The water samples were allowed to equilibrate to room temperature. Deionized-distilled water was also allowed to equilibrate at room temperature as a control where a base line for the conductivity was taken. The conductivities of each sample were then measured.

2.7 Determination of the Dissolved Oxygen (Do)

The Winkler method, otherwise known as the iodometric technique was employed. The chemistry of the analysis is based on the addition of manganese II tetraoxosulphate vi solution followed by a strong alkali-iodide solution.

$$MnSO_{4(aq)} + 2KOH_{(aq)} \longrightarrow Mn(OH)_{2\,(s)} + K_2SO_{4\,(aq)} \quad \text{(white)}$$

Dissolved oxygen rapidly form hydroxide salt with manganete II hydroxide.

$$Mn(OH)_2 + 0_2 \longrightarrow 2MnO(OH)_2 \text{ (brown).}$$

In the presence of iodide ions in an acidic solution, the oxidized manganese reverted to the divalent state and librated iodine is equivalent to the original oxygen content. This iodine librated was then titrated with a standard sodium thiosulphate solution. A blank determination was also carried out.

3. Results and Discussion

The results of the analysis for the three water samples from the various locations for temperature, P^H, suspended solids (SS), dissolved solids (DS), conductivity and dissolved oxygen (DO) are presented below in the table.

Table 1.0: Result of Analysis of DO, PH,SS,OS and conductivity.

Samples	Temp(o_C)	P^H	SS(mg/L) (10^3)	DS(mg/L)	Conductivity ($\mu s cm^{-1}$)	D.O, (Mg/L)
A	30	6.33	0.15	0.05	92	9.50
B	24	7.00	0.15	0.10	95	9.20
C	28	5.33	0.03	0.10	97	9.20
WHO Standards	20-30	6.5-8.5	1.0	-	-	9.00

The results of the analysis for the three water samples from the various locations for temperature, P^H, suspended solids (SS), dissolved solids (DS), conductivity and dissolved oxygen (DO) are presented below in the table.
From the table 1.0 above, the analysis shows temperature ranges from 24 to 30.^{o}c indicating that the temperature of the water samples are within the WHO standard range.
Temperature is important factor as it governs the kind of aquatic life that can live in a water body. All aquatic species have temperature ranges which they prefer. If temperature gets far above or below this preferred range, the number of individuals of the species decreases until only a few or none are left. Temperature is important here because it influences water chemistry. The rate of chemical reaction generally increases at higher temperatures which in turn affects biological activity. It is of note that the effect of temperature on water chemistry in turn has an impact on the dissolved oxygen.
The P^H valves ranges between 5.33 – 7.00. This is fairly acceptable except for sample C. which is becoming acidic. Natural water are complex, containing many chemicals depending on the location and dissolved substances. High P^H would result in low-concentration of dissolved oxygen while low P^H may result in high concentration of dissolved oxygen. In this case the suspended solids are below the maximum tolerable limit of 1000 mg/L set for an aesthetic acceptance for water.
Conductivity which depends on the quantity of dissolved salts present in the water sample is approximately proportional to the amount of the total dissolved solids. The analysis gave conductivity ranging from 92 $\mu s cm^{-1}$ to 97 $\mu s cm^{-1}$.
The dissolved oxygen concentration ranges between 9.2 mg/L-9.7 mg/L, which are within the tolerable limits provided by WHO. This indicates that the concentration of the dissolved oxygen is adequate for most aquatic life.

4. Conclusion and Recommendation

Dissolved oxygen is an indicator of water quality. The amount that can be held by water depends on several factors like temperature, salinity, pressure, P^H etc. The samples analysed were considered to be of minimal pollution level.

It is therefore observed that the water can tolerate aquatic life but consistent monitoring of the dissolved oxygen level is important and therefore recommended by the paper.

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