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Effect of Air Pollution on Dew Water: A Case Study of Ado-Ekiti, Nigeria

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ABSTRACT : Human existence vis-à-vis its environment is more and more getting threatened sequel to air pollution occasioned majorly by human coupled with natural activities. Earth is getting warmer, ozone layer is getting depleted, and acid rain is being experienced, all as a results of air pollution. This study seeks to investigate the effect of air pollution on dew water. Thirty one (31) samples of dew water were collected in four locations in Ado-Ekiti, Ekiti State, Nigeria. Analytical studies of the dew water samples was carried out to determine the pH, Total Dissolved Solids (TDS) and Electrical Conductivity (EC) in order to determine whether the dew water is polluted or not. The pH of dew water samples collected and analyzed ranged between 5.5 and 7.9 in Olokun Ado-Ekiti while other samples fell in between this range. In Government Reserved Area (GRA), Ajilosun and EKSU school area, the pH ranged between 6.4 and 7.9 while EC fell in between 0.0 and 0.9 mS/cm which shows that the observed zones are polluted. Several activities such as open burning of refuse, deforestation in order to make charcoal and fire woods for household cooking, usage of generating sets for household and industrial power generation and non regular servicing of motor vehicles are to be checked by an individual and government in order to ameliorate the current trend in emission of air pollutants.
KEYWORDS - *Dew, pH, Air pollution, TDS, EC, Ado-Ekiti.*

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I. INTRODUCTION

According to [1], acid rain has toxic effect on fresh aquatic life and also causes damage to plant leaves which causes change in rate of photosynthesis in the plants and causes extensive damage to historical structural building. Rain and dew as natural events, may dissolve and absorb contaminants of the air and direct them into the land or surface water which become polluted [2].

Dew water can be a good indicator of the atmospheric pollution level at a given site. Taking into account both high Total Inorganic Ionic Content (TIC) values and the annual water equivalent estimated at around 50 mm, dew is a considerable factor of wet deposition, responsible for an additional 60 % of pollutant input into the ground when compared with precipitation [3].

Changes in the pH of soil affect its fertility therefore becoming necessary to know whether observation zone is polluted or not. It is determined by simple analysis of rain water by using pH meter, conductivity meter and TDS Meter. According to [4], conductivity indicates the presence of dissolved solids in water, but does not provide information about a specific chemicals, its change might indicate a water quality problem that requires further investigation. By measurement of PH, Conductivity, and TDS of dew water, we can predict whether studied zone is polluted or not.

Dew water is the moisture which condenses from the atmosphere on plants, soil, or other surfaces near the ground. Common experience tells us that dew forms primarily during the early morning hours when the temperature approaches its minimum diurnal value. Only plants which are shallow rooted could make use of dew because the moisture penetrates only a thin layer of soil and evaporates quickly when the sun begins to warm the surface [5]. Chemical and biological analyses showed that dew water, once filtered and bottled, could be used for drinking after a light treatment to increase the pH.

Dew is a relatively neglected topic, even through measuring dew formation, the rate of accumulation and total deposition present interesting research questions [6], [7]. A major limitation in assessing the ecological and environmental role of dew is the extreme difficulty of collecting accurate measurements. In the majority of cases, dew is an important moisture input and plays a significant ecological function in most desert ecosystems

[8]. Unfortunately very scanty information is available of dew water quality. Take for instance, [3] stated that while precipitation chemistry in Poland is described quite well, very limited information concerning the composition of dew exists.

Ado-Ekiti, the capital of Ekiti State, which is located in the south western Nigeria experiences high air pollution episodes. Daily average concentrations of coarse and fine particulate matter (PM_{10} and $PM_{2.5}$) often exceed the World Health Organization (WHO) guidelines. Air pollution is one of the most important environmental problems in metropolitan cities like Ado Ekiti [9].

II. RESEARCH SETTING

The study area Figures 1 and 2 lies approximately between the latitude 7^0 33^1 and 7^0 42^1 North of the equator and the longitude 5^0 11^1 and 5^0 20^1 East on a low-land surrounded by several isolated hills and inselbergs, [10]. Geologically, the region lies entirely within the pre-Cambrian basement complex rock group, which underlies much of Ekiti State [11]. The temperature of this area is almost uniform throughout the year, with little deviation from the mean annual temperature of 27^0

Figure 3: Map of Ado –Ekiti from Google earth

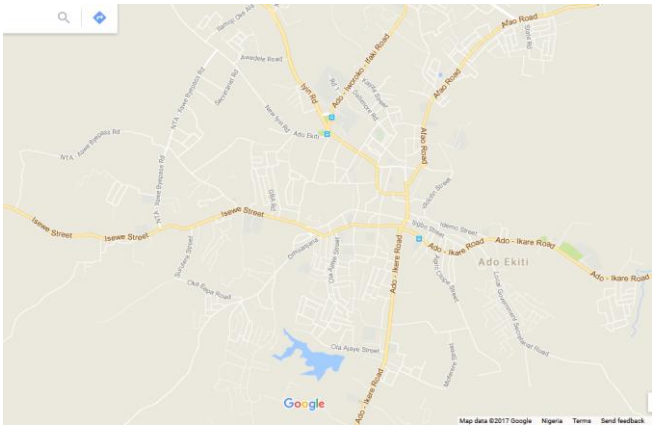

Figure 3: Road Map of Ado -Ekiti from Google earth

C. February and March are the hottest 28^0 C and 29^0 C respectively, while June with temperature of 25^0 C is the coolest [12]. The mean annual rainfall is 1,367mm with a low co-efficient variation of about 10%. Rainfall is highly seasonal with well-marked wet and dry season. The wet season lasts from April to October, with a break in August

III. RESEARCH METHODOLOGY

A. Sample Collection Points

The dew water samples were collected in the following locations:

1) GRA: (represented high economic status residential area with low vehicular and pedestrian traffic volume);
2) Olokun: (represented low economic status residential area where the houses are built of mud bricks without plastering and the floors were not paved or cemented. A lots of fire wood burning activities are taking place);
3) Ajilosun: (represented medium economic status residential area where majority of the residents either use kerosene or cooking gas for cooking); and

4) Ekiti State University (EKSU) school area (represent a typical tertiary institution environment in Nigeria.

B **Dew Water Sample Collection**

Nylon of 1.5m by 2m was used as the catchment for collecting dew water. The nylon was placed on iron shed 1.5 m above the ground level (Figures 3 and 4) constructed purposely for this research. The nylon was washed with soap and then rinsed thoroughly with distill water. Depending on the atmospheric humidity and temperature, the dew usually forms at the early hours of the day. The nylon was usually laid around 10 pm and removed around 6am. Thereafter, dew water was collected for analysis.

Figure 3: Dew water collection platform

Figure 4: Preparation of dew water collection platform by the co-researcher.

C **Calibration of the pH Meter**

Following procedure was adopted to calibrate the pH meter.

1) Prepare the buffer solution of known pH by dissolving the buffer tablets (pH 9.0 and pH 4.0) in specific volume of distilled water.
2) pH meter was switched on until the reading is stable (in line with the instruction manual of the product).
3) Adjust the temperature knob according to the temperature of solution under study.
4) Electrode of the meter was rinsed with water and then places it into a buffer with a known pH of 4.0. Set the readout display to 4.0 so the meter knows that this is what a acidic pH is. This process was repeated with another buffer that is basic (around pH 9.0).
5) Electrodes of the meter are withdrawn and rinsed in distilled water.

D **Measure the pH of dew water**

The electrode is placed in the dew water. Once the reading has stabilized on the meter, the display will be the pH of the dew water. It is to be noted that there is no documented world standard for dew water quality, however, the standard for normal rain water which is pH between 5.0 - 5.6 and acid rain pH between 4.0 - 4.4 was adopted for this study.

E **Calibration of TDS and EC meter**

i. The TDS meter was turned on

ii. The meter was immersed in KCL solution up to the maximum level

iii. The reading is allowed to stabilize and the small screwdriver turn the calibration trimmer to match the solution value "138" (multiplied by 10 = 1380ppm)

iv. The TDS meter is rinsed in distilled water and then immersed in the dew water to be measured, the reading is taken once it is stabilized.

F **Determination of total dissolved solid (TDS) of dew water**

In the determination of TDS of dew water, TDS Meter was used. Electrode of TDS meter was rinsed distilled water after which the electrode of TDS meter was dipped into the dew water sample solution, readings was noted and recorded.

IV. RESULTS AND DISCUSSION

The following Tables 1 to 4 are the results showing the pH, TDS and EC of dew water collected from Olokun, GRA, EKSU School Area and Ajilosun

Table 1: Showing pH, Conductivity, TDS of dew water in Olokun

S/no	Date	pH	TDS (ppm)	EC (mS/cm)
1	30-03-17	6.9	8.096	1.4
2	01-05-17	5.6	0	0
3	09-05-17	5.7	1.92	0.3
4	05-06-17	5.5	1.92	0
5	08-06-17	6.7	6.4	0.1
6	02-07-17	7.5	0	0
7	20-06-17	7.6	0	1.5
8	16-07-17	7	6.4	0.1
9	19-07-17	7.4	1.28	0.2
10	14-08-17	7.9	6.4	0.1
11	10-09-17	7.6	2.56	0.4

Table 2: pH, TDS and EC of dew water in G.R.A

S/no	Date	pH	TDS (ppm)	EC(mS/cm)
1	21-06-17	7.2	3.2	0.5
2	28-06-17	6.8	5.7	0.9
3	29-07-17	6.6	3.84	0.6
4	05-10-17	7.4	0	0
5	17-10-17	7.3	0	0

Table 3: pH, TDS and EC of dew water in Ekiti State University School Area

S/no	Date	pH	TDS (ppm)	EC (mS/cm)
1	01-10-17	7.1	0	0
2	02-10-17	7.5	0	0
3	06-10-17	7.4	1.28	0.2
4	09-10-17	7.9	6.4	0.1
5	17-10-17	6.7	1.28	0.2
6	18-10-17	6.6	2.56	0.4

Table 4: pH, TDS and EC of dew water in Ajilosun Ado Ekiti

S/no	Date	pH	TDS (ppm)	EC (mS/cm)
1	04-04-17	7.41	3.2	0.5
2	12-04-17	7.1	1.28	0.2
3	09-05-17	7.5	1.92	0.3
4	29-05-17	7.6	3.1	0
5	10-06-17	6.9	0	0
6	24-06-17	6.4	0	0
7	14-07-17	7	1.2	0
8	24-07-17	7.2	0	0
9	28-07-17	6.8	0	0

From Tables 1 to 4, it is shown that observation zone is having pH in between 5.5 and 7.9 while conductivity fell between 0.0 and 1.5 mS/cm. According to [1], if the observation zone having pH in between 5.0 - 1, and EC is greater than 0.8 mS/cm, it is a polluted zone. Conversely, if the observation zone is having pH in range between 5.0 - 7.1 and EC less 0.8 mS/cm, the zone is unpolluted. This can be generalized and can be used in any zone for determination of polluted or unpolluted zone. The results in Table 1, shows that the pH fell in between 5.5 and 7.9, while EC ranges between 0.0 and 1.5 mS/cm which indicated that the observed zone (Olokun) is polluted. In a similar study conducted by [3], the pH values of dew water ranged from 5.22 to 7.35 for urban coastal stations, from 5.67 to 8.02 for urban inland stations and from 4.16 to 8.76 for dew samples collected in the rural area. From Tables 2, 3 and 4, showing results of the samples collected from GRA, Ajilosun and EKSU school area respectively. In the three tables aforementioned, the pH ranged between 6.4 and 7.9 while EC fell in between 0.0 and 0.9 mS/cm which shows that GRA, Ajilosun and EKSU school area polluted. Due to pollution, climate changes, Global warming and depletion of ozone take place.

Due to global warming if the temperature of earth increases by one degree then water level in the sea will increase by fifty centimeters which causes adverse effects on human beings. Due to global warming the rate of evaporation of water from the seas, rivers, ponds will increases and this leads to untimely rains cyclones and hurricanes. Agriculture sector will be badly affected. Due to fast evaporation of surface water there will be a shortage of water for agriculture purposes. A slight increase in the global temperature adversely affects the world food production. Due to acid rain toxic effect to fresh aquatic life, damage to plants leaves, change in rate of photosynthesis in the plants and it also extensive damage to historical structural building, the PH of the soil changes which affect its fertility.

V. CONCLUSION

There have been documented cases of effects of air pollution on both human and environment in both developing and developed countries. The effects range from depletion of ozone layer, global warming, acid rain etc to lethal. This study as a preliminary investigation on the effects of air pollution of dew water is another evidence that all facet of nature are been affected by the air pollution. Several activities such as open burning of refuse, deforestation in order to make charcoal and fire woods for household cooking, usage of generating sets for household and industrial power generation and non regular servicing of vehicles are to be checked by an individual and government in order to ameliorate the current trend in emission of air pollutants.

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