Determination of Some Air Pollutants and Meteorological Parameters in Abattoir, NTAK INYANG in UYO L.G.A of AKWA IBOM State in Nigeria

Jonah, A. E.

ABSTRACT

The determination of air pollutants in Abattoir, Ntaik Inyang in Uyo L.G.A was carried out using standard analytical techniques. The pollutants monitored were NO$_2$, SO$_2$, H$_2$S, CO, NH$_3$, Cl$_2$, TVOC, CH$_2$O, PM$_{2.5}$, PM$_{10}$, Temp, Relative humidity (RH), Pressure and Wind Speed (WS). The results for the concentration of air pollutant and their Air Quality Index (AQI) reveals as follows NO$_2$ (1.36 ± 0.32(ppm), AQI=1360). SO$_2$ (2.44 ± 1.98(ppm), AQI=488). H$_2$S (3.38 ± 1940(ppm), AQI=19450). CO (1.79±1.61(ppm), AQI=334). NH$_3$ (7.8±2.26(ppm), AQI=156). Cl$_2$ (1.47± 1.29(ppm), AQI= 147). HCN (11.56±7.93(mg/m$^3$), AQI=115,600). TVOC (164±0.46(mg/m$^3$), AQI=328). CH$_2$O (0.23±0.12(mg/m$^3$), AQI=0.276). PM$_{2.5}$ (43.2±0.95(µg/m$^3$), AQI=172.8). PM$_{10}$ (74.8±1.55(µg/m$^3$), AQI=149.6). Temp (27.5±4.6°C). Relative humidity (RH) (74.6 ± 4.6%). Press (1006.7±0.84(kpa). W.S (1.56±0(m/s)). The result showed that NO$_2$, SO$_2$, H$_2$S, CO, NH$_3$, Cl$_2$, HCN, TVOC, PM$_{2.5}$ and PM$_{10}$ were higher than that of FEPA standard limit. The correlation analysis revealed that NO$_2$ shows positive relationship with H$_2$S, and W.S at 0.05 significant level and negatively with Cl$_2$ and Press at 0.01 significant level, and negatively with PM$_{2.5}$ and PM$_{10}$ at 0.05 significant level. SO$_2$ correlated positively with CO at 0.01 significant level, TVOC and CH$_2$O at 0.05 significant level. SO$_2$-NH$_3$ at 0.05 significant level but negatively. H$_2$S shows a relationship with Temp but positively at 0.01 significant level and 0.05 significant level with HCN, H$_2$S also correlated negatively with NH$_3$ and Press at 0.01 significant level. While CO shows a correlation with NH$_3$ at 0.05 significant level but negatively, NH$_3$-RH positively at 0.01 significant, NH$_3$-Press at 0.05 significant level. Also, NH$_3$ shows a negative relationship with TVOC, CH$_2$O and Temp at 0.05 significant level. Cl$_2$ correlated strongly but positively with Press at 0.01 significant level, Cl$_2$-PM$_{2.5}$ and PM$_{10}$ at 0.05 significant level and a negative relationship with W.S at 0.05 significant level. HCN-W.S negatively at a 0.05 significant level. TVOC correlated positively with CH$_2$O and negatively with RH at 0.01 significant level, and a positive relationship with PM$_{2.5}$ and PM$_{10}$ at 0.05 significant level. CH$_2$O correlated negatively with RH at 0.01 significant level and positively with PM$_{2.5}$ and PM$_{10}$ at 0.05 significant level. PM$_{2.5}$ shows a positively relationship with PM$_{10}$ at 0.01 significant level. This result in an indication of the presence of possible air pollutants in the of the study area which may result in many health problems.

Key words: Pollution, Air Pollution and meteorological parameters.

INTRODUCTION

Atmospheric pollution is a condition in which certain substances, which include gases (sulphur dioxide, nitrogen oxides, carbon monoxides hydrocarbons etc.), particulate matters (smoke, dust, fumes, aerosols, etc.), radioactive materials and many others are present in such concentrations that may produce undesirable effects on man and ecosystem [17].

Human exposure to air pollutants is unavoidable in today’s perspective especially in the urban areas of most developing countries. Though, air pollution could be due to natural sources, a major anthropogenic source of air pollutant is due to man’s quest for a better standard of living and the utilization of natural sources for rapid industrialization, urbanization and consequently causing excessive air pollution. Hence, air pollution problems have continued to receive a great deal of interest worldwide due to its negative impact on human health and welfare [4]. Among the reported cases of extreme air pollution conditions that affects humanity include the issues of high blood pressure and cardiovascular problems [17]. Air pollution, therefore, is a serious threat to environmental health in many cities of the world today.
An abattoir is a slaughterhouse, or a place where animals are killed.[7]. Studies in Nigeria and other developing countries have established that poor waste management is responsible for the environmental and health hazards associated with abattoirs.

The hazards have indirectly threatened or endangered the health of residents and the environment in general. This is because animal waste such as blood, bones, intestinal content, tissues, hides and skin are scattered in huge piles around the abattoirs [14]. For example, waste generated in abattoirs is usually directed into rivers or the run-off gutters of adjoining buildings. This attracts flies and a stench that affects adjoining residences [9].

The waste water emanating from abattoir pollutes surface and underground water as well as the air. The pungent stench forces neighboring residents to shut their windows and doors, thus disallowing cross ventilation in homes. The piled-up waste also causes air pollution, which subsequently produces methane gas that intensifies the greenhouse effect on global warming. As a result, abattoirs-related environmental and health hazards have become prevalent [13].

THE STUDY AREA
Abattoir which is the focus of this study is located at Uyo in Ntak Inyang of Akwa Ibom State. Uyo lies between longitude 007°55'41.9''N and latitudes 05°04'22.5''11N and Elevation 44(m), An average number of slaughtered animals per day are like 200 cows or more, even sheep and goats. Normal abattoir operations are carried out from Monday to Saturday.

MATERIALS
Equipment used in detecting the air pollutants are listed in the table below.

Table 1: Materials used in determining the air pollutants

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Equipment’s Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO₂</td>
<td>NO₂ gas monitor Gasman Model 19648H</td>
</tr>
<tr>
<td>SO₂</td>
<td>SO₂ gas monitor Gasman Model 19831H</td>
</tr>
<tr>
<td>H₂S</td>
<td>H₂S gas monitor Gasman Model 19502H</td>
</tr>
<tr>
<td>CO</td>
<td>CO gas monitor Gasman Model 19252H</td>
</tr>
<tr>
<td>NH₃</td>
<td>NH₃ gas monitor Gasman Model 19730H</td>
</tr>
<tr>
<td>Cl₂</td>
<td>Cl₂ gas monitor Gasman Model 19812H</td>
</tr>
<tr>
<td>HCN</td>
<td>HCN gas monitor Gasman Model 19773H</td>
</tr>
<tr>
<td>TVOC</td>
<td>TVOC gas monitor Gasman Model Air Ae Steward air quality monitor</td>
</tr>
<tr>
<td>CH₂O</td>
<td>CH₂O gas monitor Gasman Model Air Ae Steward air quality monitor</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>PM₁₀ gas monitor Gasman Model Air Ae Steward air quality monitor</td>
</tr>
</tbody>
</table>

Other instrument was, Max/Min Thermometer (Model No: KTJTA 318) used for measuring the temperature and digital Anemometer (MASTECH MS 6252A)

Determination of Air Quality Index

Air quality index (AQI) is an overall measure of the status of a place under consideration. On the basis of air quality index “Q”, the quality rating of each parameter was obtained by the formula given below [2].

\[ Q = \frac{(O/Ps)}{X 100} \]

Where:
- \( Q \) = Quality Ratings
- \( O \) = Observed value
- \( Ps \) = Prescribed Standards as Permissible Limit.

Subsequently, the geometric mean of this “n” number of quality ratings “Q” was estimated, which is known as AQI.

RESULTS AND DISCUSSION
RESULTS

Figure 1: The Result of Some Air Pollutants and Meteorological Parameters in Abattoir, Ntak Inyang in Uyo L.G.A of Akwa Ibom State in Nigeria

FEPA -Federal Environmental Protection Agency

Table 2: The Air Quality Index of Air Pollutants Analyzed

<table>
<thead>
<tr>
<th>Air Quality Contaminant</th>
<th>AQI</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO₂ (ppm)</td>
<td>1360</td>
</tr>
<tr>
<td>SO₂ (ppm)</td>
<td>488</td>
</tr>
<tr>
<td>H₂S (ppm)</td>
<td>1940</td>
</tr>
<tr>
<td>CO (ppm)</td>
<td>334</td>
</tr>
<tr>
<td>NH₃ (ppm)</td>
<td>156</td>
</tr>
<tr>
<td>Cl₂ (ppm)</td>
<td>147</td>
</tr>
<tr>
<td>HCN (ppm)</td>
<td>115600</td>
</tr>
<tr>
<td>TVOC (mg/m³)</td>
<td>328</td>
</tr>
<tr>
<td>CH₂O (mg/m³)</td>
<td>0.276</td>
</tr>
<tr>
<td>PM₂.₅ (µg/m³)</td>
<td>172.8</td>
</tr>
<tr>
<td>PM₁₀ (µg/m³)</td>
<td>149.6</td>
</tr>
</tbody>
</table>

Table 3: Air quality categorizes based on the air quality index by central pollution control board (CPCB), 2009.
Source: CPCB (2009), AQI- Air Quality Index
DISCUSSION

Nitrogen (iv) oxide (NO\textsubscript{2}) recorded a mean concentration of (1.36 ± 0.32ppm). The valve in above the range of 0.1 set by FEPA and could rise beyond this if control measures are not put in place, prolong inhalation of NO\textsubscript{2} has been reported to cause premature death, stroke, heart disease, lung cancer, lung infection, asthma and chronic obstructive pulmonary diseases respiratory infection in children, coughing and wheezing [6]. This value, when subjected into air quality index (AQI) reveals that, the air is severely polluted.

The mean concentration of sulphur (iv) oxide (SO\textsubscript{2}) recorded was 2.44 ± 1.98ppm) which is above the range of 0.05-0.5ppm recommended by FEPA. This shows that SO\textsubscript{2} is as higher rate and constant exposure air around the site may result in eye problem, mucous membrane, respiratory tracks redness and blister of skin, Bronchospasm edema, pneumonitis and acute air-way obstruction [1]. This value, when subjected into air quality index (AQI) reveals that the air is severely polluted.

Hydrogen sulphide (H\textsubscript{2}S) recorded a mean concentration of (3.88 ± 1.05 ppm). This range is above the federal environmental protection agency (FEPA) range (0.15-0.2ppm) as thus, an indication the air quality around the study sit in poor and could possess some health problem such as cough, premature death, respiratory infection, cancer [12]. This value when subjected to Air Quality Index (AQI) reveals that, the air is severely polluted.

Carbon monoxide shows a mean concentration of (179 ± 1.61pmm). This value in within the standard range (1.0-5.0ppm) set by FEPA. High CO may result in death as the gas combine readily with hemoglobin in red blood displacing oxygen and forming insoluble carboxyhemoglobin. It may also lead to tissue damage after prolong exposure and its affinity for hemoglobin is almost 220 times greater than that of oxygen [20]. This value, when subjected to air quality index (AQI), reveal that, the air is fairly clean which fall in a range of (25-50).

Ammonia (NH\textsubscript{3}) recorded a mean concentration of (7.8 ± 2.26ppm). This value is above the Federal Environmental Protection Agency (FEPA) range of (2.0-5.0ppm) health problem in human. The high concentration of ammonia recorded may be accredited to agricultural process, vehicular emission and vitalization from soils and ocean as reported by [3]. This value when subjected to air quality index (AQI) reveals that, the air is severely polluted.

Ammonia (NH\textsubscript{3}) recorded a mean concentration of (7.8 ± 2.26ppm). This value is above the Federal Environmental Protection Agency (FEPA) range of (2.0-5.0ppm) health problem in human. The high concentration of ammonia recorded may be accredited to agricultural process, vehicular emission and vitalization from soils and ocean as reported by [3]. This value when subjected to air quality index (AQI) reveals that, the air is severely polluted.

The mean concentration of chlorine (Cl\textsubscript{2}) ranges from (1.47 ± 1.29ppm). This value is above the FEPA range of (0.03-0.1ppm) consequently inhalation of these gas may lead to attack on the respiratory system, eye problem and skin effect. The high level of chlorine from this study arise from burning of PVC rubbers and tire which are used in roasting the skin of the animals. This value when subjected to air quality index (AQI) reveal that, the air severely polluted.

<table>
<thead>
<tr>
<th>S/N</th>
<th>AQI of Ambient Air</th>
<th>Prescription of Ambient Air Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;10</td>
<td>Clean</td>
</tr>
<tr>
<td>2</td>
<td>10 – 25</td>
<td>Clean</td>
</tr>
<tr>
<td>3</td>
<td>25 – 50</td>
<td>Fairly Clean</td>
</tr>
<tr>
<td>4</td>
<td>50 – 75</td>
<td>Moderately Polluted</td>
</tr>
<tr>
<td>5</td>
<td>75 – 100</td>
<td>Polluted</td>
</tr>
<tr>
<td>6</td>
<td>100 – 125</td>
<td>Heavily Polluted</td>
</tr>
<tr>
<td>7</td>
<td>&gt;125</td>
<td>severely polluted</td>
</tr>
</tbody>
</table>
Hydrogen cyanide shows a mean concentration of 11.56 ± 7.93 ppm. This value is highly above the limit range set as in [10] (0.01 ppm). The high level of hydrogen cyanide reported for this study may be from burning of rubbish containing PVC. Prolong inhalation of HCN gas may lead to human poisoning, respiratory problem. When subjected into air quality index (AQI) reveals that, the air is severely polluted.

Volatile organic compound recorded a mean concentration of (1.64 ± 0.46 mg/m³) which is above the standard limit (0.33 - 0.5 mg/m³) as in [10]. This high level of TVOC recorded may be due to burning of PVC rubbers and tire which are used in roasting the skin of the animals. Hence concentration of VOCs in the study area may result in death, lead to severe dungs or to human health like cough, lung problem and environmental effects reported as in [19]. This value when subjected into air quality index (AQI) reveals that, the air is severely polluted.

The mean concentration of formaldehyde (CH₂O) reported was (0.23 ± 0.12 mg/m³). This value is above the range of (0.012 mg/m³) set as in [10] and could rise beyond that if adequate measure is not taken. Prolong inhalation of these gas may lead to significant danger to human health such as heart disease lung cancer, premature death reported as in [15]. This value when subjected into air quality index (AQI) reveal that the air was very clean.

Suspended particulate matter (SPM) is a term used to indicate very small solid and liquid particles in the air. Particulate matter (PM₁₀) obtain from this study show the second highest a mean concentration of (43.2 ± 0.95µg/m³) which is above the standard limit of (25µg/m³) set as in [10]. These high level of Spm₂.₅ recorded may be due to as a result of massive burning of tire in the study area. Hence concentration of PM₂.₅ in the study area may result in lungs and heart conditions eye infection, asthma, chronic bronchitis in people exposed it for a long time [8]. This value when subjected into air quality index (AQI) reveal that, the air is severely polluted.

Particulate matter (PM₁₀) recorded a mean concentration of (74.8 ± 1.15µg/m³). This value is higher than the range of (50µg/m³) set as in [10]. Study has shown that this high concentration may be as a result of massive burning of tire in the study area. Hence prolong inhalation of PM₁₀ may lead to cough, eye infection, asthma in respiratory and cardiovascular disease death reported as in [16]. This value when subjected into air quality index (AQI) reveal that, the air is severely polluted.
### TABLE 4: correlation of gaseous pollutants with some meteorological parameters.

<table>
<thead>
<tr>
<th>Gaseous Pollutants</th>
<th>NO$_2$</th>
<th>SO$_2$</th>
<th>H$_2$S</th>
<th>CO</th>
<th>NH$_3$</th>
<th>Cl$_2$</th>
<th>HCN</th>
<th>TVOC</th>
<th>CH$_3$O</th>
<th>PM$_{2.5}$</th>
<th>PM$_{10}$</th>
<th>TEMP</th>
<th>RH</th>
<th>Press</th>
<th>W.S</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO$_2$</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO$_2$</td>
<td>0.259805</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H$_2$S</td>
<td>0.557605*</td>
<td>0.052706</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>0.147468</td>
<td>0.941136**</td>
<td>-0.08869</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NH$_3$</td>
<td>-0.41638</td>
<td>-0.6166*</td>
<td>-0.7834**</td>
<td>-0.52185*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cl$_2$</td>
<td>-0.9885**</td>
<td>-0.36882</td>
<td>-0.47868</td>
<td>-0.24244</td>
<td>0.410094</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCN</td>
<td>0.206357</td>
<td>-0.23423</td>
<td>0.555798*</td>
<td>-0.0562</td>
<td>-0.39731</td>
<td>-0.0831</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TVOC</td>
<td>-0.33012</td>
<td>0.608321*</td>
<td>0.14498</td>
<td>0.459858</td>
<td>-0.5431*</td>
<td>0.255382</td>
<td>-0.33747</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CH$_3$O</td>
<td>-0.36615</td>
<td>0.585734*</td>
<td>0.125126</td>
<td>0.443651</td>
<td>-0.52072*</td>
<td>0.292852</td>
<td>-0.33691</td>
<td>0.999239**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM$_{2.5}$</td>
<td>-0.6382*</td>
<td>-0.25899</td>
<td>0.080436</td>
<td>-0.40808</td>
<td>0.012703</td>
<td>0.645616*</td>
<td>-0.28549</td>
<td>0.602509*</td>
<td>0.622896*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>-0.5402*</td>
<td>-0.23195</td>
<td>0.263803</td>
<td>-0.38706</td>
<td>-0.15177</td>
<td>0.564364*</td>
<td>-0.13508</td>
<td>0.621553*</td>
<td>0.638572*</td>
<td>0.980752**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEMP</td>
<td>0.409194</td>
<td>0.197388</td>
<td>0.812167**</td>
<td>-0.09278</td>
<td>-0.67165*</td>
<td>-0.39638</td>
<td>-0.01955</td>
<td>0.48801</td>
<td>0.467829</td>
<td>0.413008</td>
<td>0.528681*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RH</td>
<td>0.329499</td>
<td>-0.49485</td>
<td>-0.35767</td>
<td>-0.45784</td>
<td>0.715973**</td>
<td>-0.31341</td>
<td>-0.15784</td>
<td>-0.8709**</td>
<td>-0.8739**</td>
<td>-0.49842</td>
<td>-0.58417*</td>
<td>-0.41452</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Press</td>
<td>-0.8015**</td>
<td>0.074592</td>
<td>-0.88761**</td>
<td>0.250007</td>
<td>0.525403*</td>
<td>0.730132**</td>
<td>-0.38826</td>
<td>0.178837</td>
<td>0.205202</td>
<td>0.142181</td>
<td>-0.00437</td>
<td>-0.7410**</td>
<td>-0.0845</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>W.S</td>
<td>0.620567*</td>
<td>0.171011</td>
<td>-0.13343</td>
<td>-0.0035</td>
<td>0.229022</td>
<td>-0.69072*</td>
<td>-0.57983*</td>
<td>-0.27881</td>
<td>-0.30362</td>
<td>-0.40154</td>
<td>-0.46663</td>
<td>0.129536</td>
<td>0.647875*</td>
<td>0.2809</td>
<td>1</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (2 tailed)

* Correlation is significant at the 0.05 level (2 tailed)
Correlation Analysis

Correlation matrix in Table 4 has the following relationship among the air particulates. NO₂ shows a strong negative correlation between Cl₂ and Press at 0.01 with (r = -0.9885, -0.8015 respectively) and 0.01 limit with PM₁₀, PM₁₀ (r = -0.6382, -0.5402) this shows that as NO₂ increases the concentration of PM₁₀, PM₁₀, Cl₂ and Press decrease and vice versa. However, there was a strong positive correlation between NO₂ with W.S and H₂S at 0.05 level with (r = 0.62057 and 0.557605 respectively). This shows that the source of NO₂ may have also contributed significant concentration of H₂S and W.S into the air of environment studied.

SO₂ correlated strongly positively with CO at 0.01 level r values = 0.941136 and strongly but positively with TVOC and CH₂O at 0.05 level with (r = 0.608321 and 0.585734 respectfully). This has revealed the common source of this pairs as reported in[18]. Also, SO₂ shows a strong negative relationship with NH₃ at NH₃ at 0.05 level with (r = -0.6166). This indicate that as NH₃ increases SO₂ decreases and vice versa.

Hydrogen sulphide shows a correlation relationship at 0.01 level with Temp with (r = 0.81216) and at 0.05 level with HCH with (r = 0.555798). This has revealed the common source of this pairs of air contaminant reporteds in[18] that, high correlation among parameters signify their familiar source. HCN also correlated strongly negatively with Press and NH₃ at 0.01 level respectively with (r = -0.8872167 and -0.7834 respectively). This indicated that as pressure and NH₃ increases H₂S decreases and vice versa. However, there was no significant correlation with others parameters.

Carbon monoxide (CO) correlated negatively but strongly with NH₃ at 0.05 level with (r = -0.52185). Results shows that as CO increases the level of NH₃ decreases and vice versa.

Ammonia show a positive strong correlation with RH at 0.01 level with (r = 0.715973) and Press at 0.05 level with (r = 0.525403). This revealed that RH and Press may have emanated from a similar source with NH₃ within the area studied. This correlation analysis also indicated that Temp, CH₂O and TVOC showed a negative correlation with NH₃ at 0.05 level with (r = -0.67165, -0.52072 and -0.5431). This indicated that as the concentration of NH₃ increases that of Temp, CH₂O and TVOC decreases and vice versa.

Correlation analysis between Chlorine and Pressure showed a strong positive relationship at 0.01 level with (r = 0.730132) and at 0.05 level with PM₂.₅ and PM₁₀ (r = 0.64516 and 0.564364). This shows that as the concentration of chlorine may have been as a result of increase in Press, PM₂.₅ and PM₁₀ respectively. However, there was a negative relationship between Cl₂ and W.S at 0.05 level with (r = -0.69072). These indicate that, as Cl₂ decrease W.S increases and vice versa.

Correlation analysis between HCN and W.S shows negative relationships at 0.05 level with (r = -0.579983). This indicate that as HCN decreases, W.S increases and vice versa.

TVOC shows a strong positive correlation with CH₂O at 0.01 level with (r = 0.999239) also with PM₂.₅ and PM₁₀ at 0.05 level with (r = 0.602509 and 0.621553). These shows that CH₂O, PM₂.₅ and PM₁₀ may have emanated from a similar source with TVOC within the area of the study. However, there was a negative correlation between TVOC and RH at 0.01 level (r = -0.8709). This shows that, as the concentration of TVOC increases that of RH decreases.

Formaldehyde shows a strong positive correlation with PM₂.₅ and PM₁₀ at 0.05 level with (r = 0.622896 and 0.638572). This shows that PM₂.₅ and PM₁₀ may have also contributed significant concentrations to the source of CH₂O in the air of the environment studied. Result also indicated that CH₂O correlated negatively with RH at 0.01 level with (r = -0.8739). These indicated that as CH₂O decreases RH increases and vice versa.

PM₂.₅ shows a strong and positive correlation with PM₁₀ at 0.01 level with (r = 0.980752). This shows that PM₁₀ may have emanated from a similar source with PM₂.₅ within the area studied.

Correlation analysis between PM₁₀ and Temp at 0.05 level with (r=0528681). This indicates that, Temperature may have contributed significant to the concentration of PM₁₀ in the air of the environment. There was a correlation but negative with RH at 0.05 level with (r = -0.58417). This indicate that as RH decreases the level of PM₁₀ increases and vice versa.

Temperature shows a negative correlation with press at 0.01 level with (r = 0.7410). Result indicate that as Temp decreases, Pressure increases and vice versa.
There is a strong positive correlation between RH and W.S at 0.05 level with \( r = 0.647875 \). This shows the common source of this pairs of air contaminants.

**CONCLUSION**

Based on the result of this research work, it was concluded that air in Abattoir, Ntak Inyang in Uyo L.G.Ain Nigeria contains concentrations of various pollutants under investigation. The presence of these pollutants at variable levels indicate possible health implications. The presence of these pollutants is due to some Abattoir activities within the area. The high concentration of particulate matter (PM\(_{10}\), and PM\(_{2.5}\)), CO and Cl\(_2\), HCN, TVOC, may be attributed to massive burning of PVC rubbers and tire which are used in roasting the skin of the animals. Decomposition of organic wastes may be the major sources of these air contaminants/pollutants (NO\(_2\), H\(_2\)S, NH\(_3\)) in the area under investigation.

**REFERENCES**


