

# IMPACT OF CEMENT DUST ON PHYSICO-CHEMICAL PROPERTIES OF SOILS AROUND A CEMENT FACTORY IN BAGALKOT, KARNATAKA, INDIA.

## ABSTRACT

**Aims:** To study the physico-chemical properties of soil around the cement factory to examine the effect of the industrial dust on the soil properties and to analyse the relation between the proportion of pollutants and the distance from the cement factory.

**Study design:** To achieve the goal, ~~we~~<sup>use third person</sup> used simple statistical methods like percentage and graphs. Along with these, Pearson correlation method ~~is made use of~~<sup>was used</sup> to analyse the relation between concentration of different elements in the soil samples and ~~distances~~<sup>the</sup> in four directions.

**Place and Duration of Study:** For the purpose of determining physico-chemical properties of the soils, samples ~~have been~~<sup>were</sup> collected from around ~~the~~ J k Cement factory near Muddhapura of Mudhol Taluk of Bagalkot district in the pre monsoon period at four directions. ~~Further, the samples have been tested by~~<sup>Furthermore were using</sup> Titration Method, ~~Titration~~<sup>m</sup> Method, ~~Flame~~<sup>m</sup> photometer method. ~~Olsen method is used~~<sup>f</sup> to determining physico-chemical properties. ~~Along with these, Pearson correlation method is made use of to analyse the relation between concentration of different elements in the soil samples and distances in four directions.~~<sup>e</sup> ~~Repeatition Delete!~~

**Results:** Analysis of these samples showed that ~~there is~~<sup>the</sup> considerable increase in concentration of many chemicals around the cement factory. It ~~can be~~<sup>was</sup> observed that majority of correlations are negative; implying that their concentration decreases with increasing distances. Major elements, among these ~~are~~<sup>were</sup> P, Ca, and Mg etc. However, there ~~are~~<sup>list all elements or keep to the major ones</sup> some exceptions such as OC, N, S, Na, Zn, and Fe whose concentration in the soil samples ~~increased~~<sup>were</sup> with ~~increase~~<sup>the</sup> in distances in all directions. Since ~~their~~<sup>T</sup> correlation with distance is positive and significant since the P-value is less than 0.05.

**Conclusion:** In the present study, it has been established that the physico-chemical properties of the soils around the factory have been changed due to the dust deposition as it is adversely affecting the composition soils. This in turn ~~affecting~~<sup>affected</sup> the concentration of nutrients required for plants growth. Further, ~~it may become hazardous to soil, flora and fauna.~~<sup>more</sup>

**Keywords:** physico-chemical, proportion, pollutants, correlation

\* Only four (4) references are cited, this is not sufficient.

## 1. INTRODUCTION

\* The literature presented is not enough; include more review on the previous research conducted to study soil properties in different cement manufacturing companies

Cement industries are considered as highly polluting industries by the Central Pollution Control Board (CPCB) as they are causing all the three types of pollution viz. air, water and soil pollution. The dust emitted from cement plants are of two categories. They are (i) cement and clinker dust which contain cement mineral compounds (Crolius, 1992), (ii) category The second category is the raw mill and percipitate dust that have not been calcined and they contain calcium carbonates, oxides of iron, silicon, aluminium, magnesium and other minor elements (Maina, 2013).

\* Literature review on the techniques used by other researchers and result obtained on the effect of cement dust on soil, human and animals should be presented.

The previous studies show that cement dust is major pollutant of soil. The pollutants are emitted at every stage of the manufacturing process, including extraction of the raw materials, crushing, Production etc. (Okoro, Orimolade, Adebayo and Akande, 2017.) The dust emitted from the cement factories is usually deposited around the factories. Concentration of the dust goes on decreasing as we move away from the factory. The concentration of dust is higher corresponding to the dominant direction of wind i.e south-west to north-east in the study area. Cement dust changes elemental concentration of soil and also changes its physicochemical properties (Khamparia, Chattergee and Sharma, 2012). Change in properties of soils due to deposition of the dust adversely affects not only soils but also plants and animals.

\* Include information on the Pearson Correlation; what it measures, how it measures and what the values mean.

The study area constitutes a part of the Deccan plateau of Karnataka State in India and covered by black soils which are rich in iron, lime and magnesium carbonate but poor in phosphorus, nitrogen and organic matter. ~~(But the soils around the factory have lost their original properties due to the dust deposition.)~~ <sup>The properties of the soil around the factory have been affected</sup> ~~Therefore, there is a need for monitoring and evaluation of the cement manufacturing industries in order to mitigate the cement dust. Thus, the present study makes an attempt to analyse the impact of cement dust deposition on some elemental physico-chemical properties of soil cover in the vicinity of JK cement factory of Bagalkot district.~~ <sup>There is therefore evaluating</sup>

Rephrase

## 2. Material and methods

For the purpose of determining physico-chemical properties of the soils, 16 top soil samples from the depth of 0-15 cm, from various distances such as 0.25 km, 0.5 km, 0.75 km and 1 km in four directions viz. South-west, south-east, north-west and north-east have been collected from the study area in the pre

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monsoon period in which south-west monsoon winds are dominant. ~~Further,~~ <sup>The</sup> ~~the~~ <sup>were</sup> samples have been tested by <sup>t</sup> Titration Method, technique where a solution of known concentration is <sup>was</sup> used to determine the concentration of an unknown solution. The concentration of the unknown <sup>was</sup> is determined by the volume of titrant. <sup>To</sup> ~~to~~ determine the concentration of certain metal ions viz. sodium, potassium, lithium, and calcium, <sup>was</sup> flame photometer <sup>This</sup> is used. It is a controlled flame test with the intensity of the flame colour quantified by photoelectric circuitry.

~~While,~~ <sup>was</sup> Oslen method ~~is~~ used to determine the relative bioavailability of ortho-phosphate in soils. Along with ~~these,~~ <sup>was</sup> Pearson correlation method <sup>used</sup> is ~~made use of~~ to analyse the relation between concentration of different elements in the soil samples and distances in four directions.

<sup>research was</sup>  
**3. The aim of this paper will be achieved with the following objectives:**

1. To study the physico-chemical properties of soil around the cement factory
2. To examine the effect of the industrial dust on the soil properties
3. To analyse the relation between the proportion of pollutants and the distance from the cement factory.

\* Report on the equipment used to conduct analysis.

**4. Study Area**

The district of Bagalkot is situated entirely on the North Karnataka Plateau, which is part of the Deccan Plateau and Located in north-central Karnataka, Bagalkot is surrounded by Belgaum District to the west, Bijapur District and Kalburgi District to the north and north-east, Raichur District to the east and Koppal, Gadag and Dharwad Districts to the south-east, south and south-west respectively.

It is positioned at 16°12'N 75°45'E and covers an area of 6593 km<sup>2</sup>. Bagalkot district has six taluks- Bagalkot, Badami, Hunagunda, Mudhol, Jamkhandi, Bilgi. According to the 2011 census Bagalkot district has a population of 18,90,826, the district has a population density of 288 inhabitants per square kilometre. There are six cement industries in Bagalkot district which are located at various places such as Mudhol, Lokapur, Bilagi and Bagalkot. The JK Company established a cement industry at Muddhapura of Mudhol Taluk In the year 2005. The cement plant is located at the distance of 20 km from taluk head quarters Mudhol.

Unless it is the paper's template, remove this section and incorporate in the last paragraph of the introduction.

You can include a map and highlight the study area. Ignore

~~all in the res. it's so hard, there are results measurement in paper but there is no table.~~

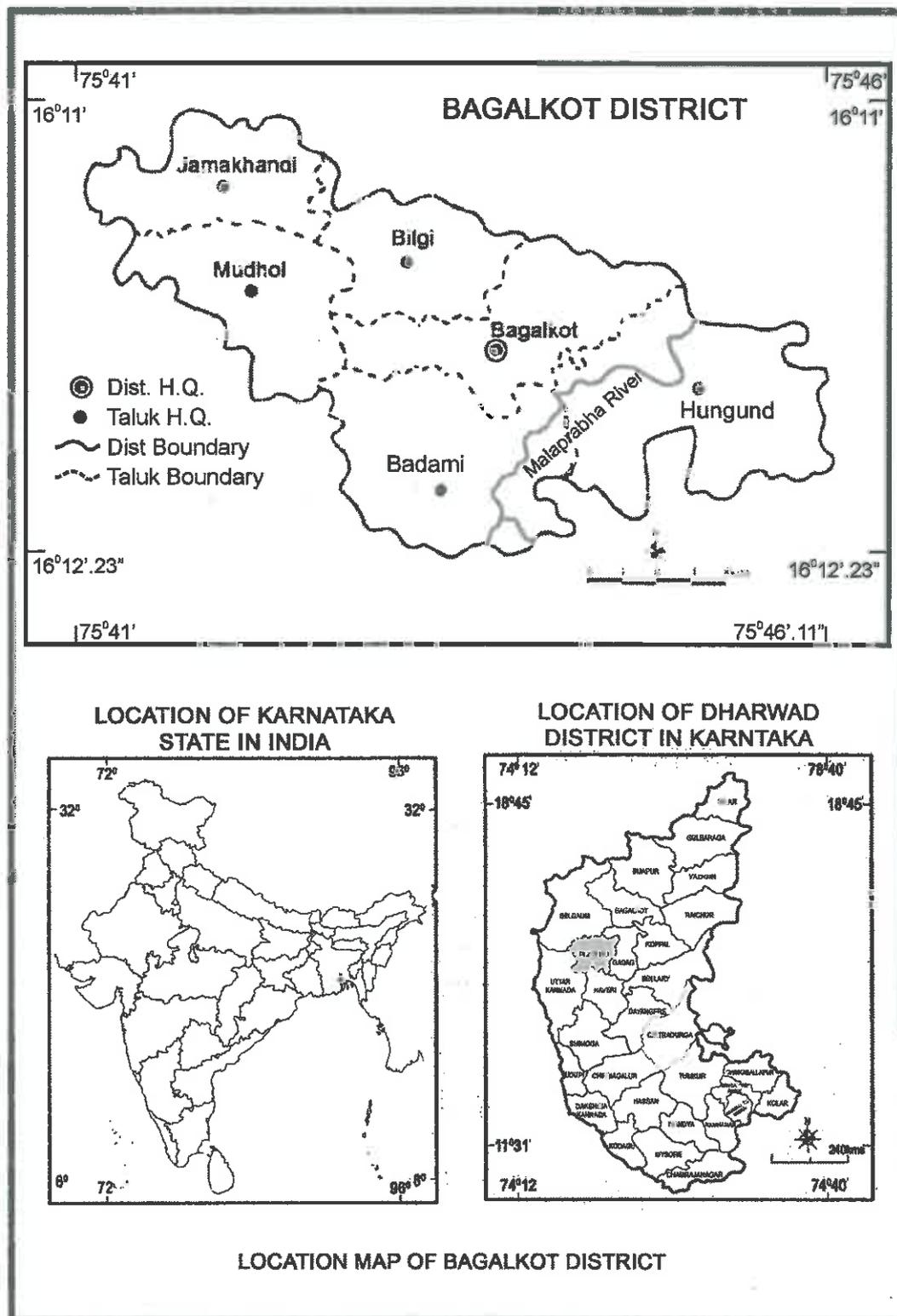
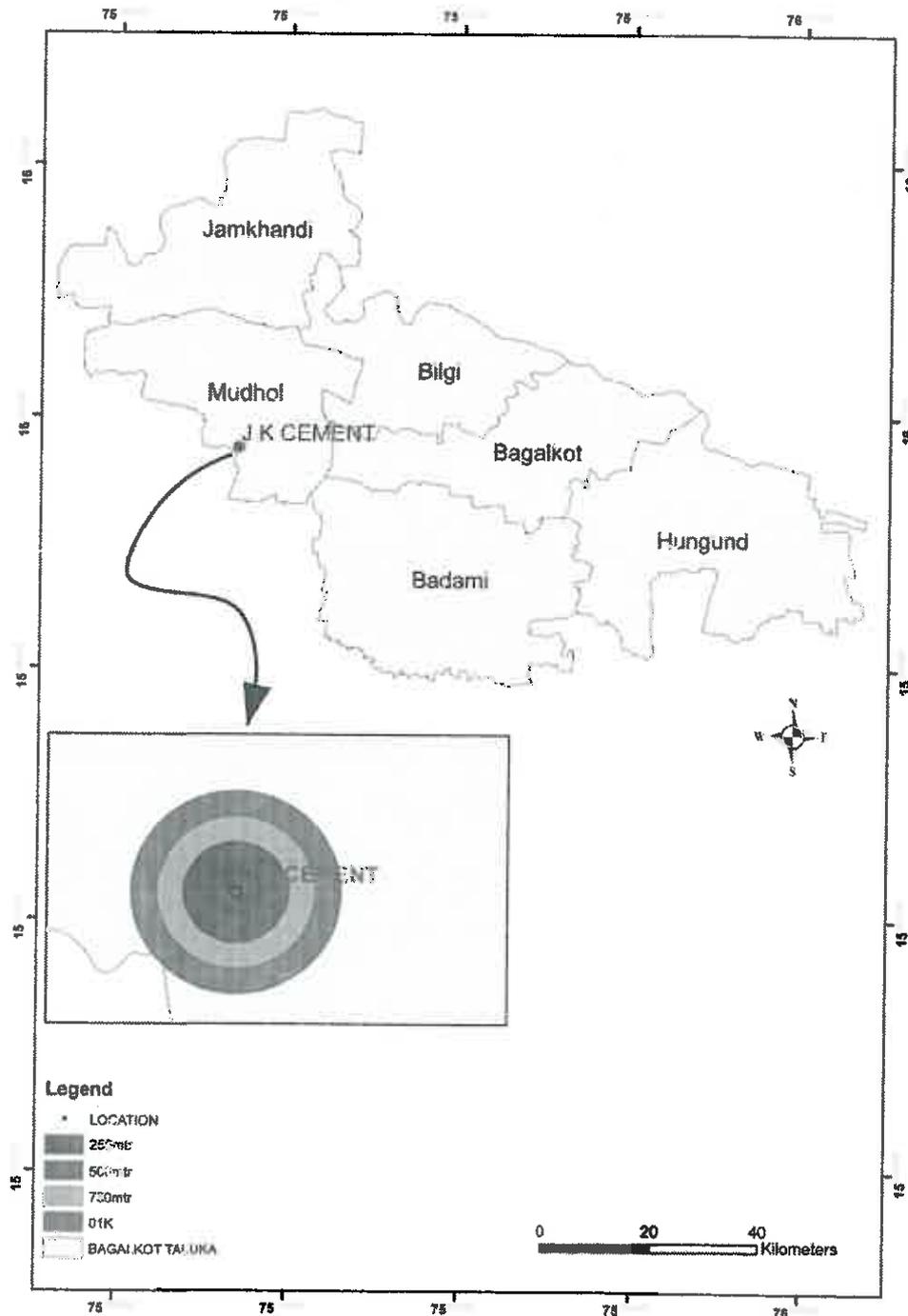


Fig 1 *Caption figure and reference the source*



**Fig. 02** — Be consistent with numbering the figures, follow the required format.  
 ↗ Reference Source.

LOCATION OF JK CEMENT FACTORY, MUDHOL, BAGALKOT DISTRICT

**Table 1. Physicochemical properties of soil and Methods**

| Sl No | Elements          | Abbreviation of Elements | Methods              | Measurements                               |
|-------|-------------------|--------------------------|----------------------|--|
| 01    | pH                | Potential Hydrogen       | pH meter             |  |
| 02    | EC                | Electrical Conductivity  | Conductivity meter   |  |
| 03    | OC                | Organic Carbon           | Titration Method     | g.kg-                                      |
| 04    | N                 | Nitrogen                 | Kjeldas Method       | kg/ha(kilo gram per hectare)               |
| 05    | P                 | Phosphorous              | Olsen Method         | kg/ha(kilo gram per hectare)               |
| 06    | K                 | Potassium                | Flame photometer     | kg/ha(kilo gram per hectare)               |
| 07    | S                 | Sulphur                  | Turbidimetric Method | kg/ha(kilo gram per hectare)               |
| 08    | Na                | Sodium                   | Flame photometer     | me/100gm (milli equivalents per 100 gram ) |
| 09    | Ca                | Calcium                  | Titration Method     | me/100gm (milli equivalents per 100 gram ) |
| 10    | Mg                | Magnesium                | Titration Method     | me/100gm (milli equivalents per 100 gram ) |
| 11    | Zn                | Zink                     | DTPA Extract (AAS)   | ppm(parts per million )                    |
| 12    | Fe                | Iron                     | DTPA Extract (AAS)   | ppm (parts per million )                   |
| 13    | Mn                | Manganese                | DTPA Extract (AAS)   | ppm(parts per million )                    |
| 14    | Cu                | Copper                   | DTPA Extract (AAS)   | ppm (parts per million )                   |
| 15    | CaCO <sub>3</sub> | Calcium Carbonate        | Titration Method     | me/100gm(milli equivalents per 100 gram )  |

Source:APHA

## 5. RESULTS AND DISCUSSION

Analysis of <sup>the</sup> these samples showed that there is <sup>a</sup> considerable increase in concentration of many ~~elements/constituents~~ <sup>chemicals</sup> around the cement factory. Table no. 2 shows that mean concentration of different elements at various distances from the cement factory, while <sup>Table 3 shows</sup> the third table reveals the correlation of concentration of elements in the soil samples over different distances in all directions. It can be observed that majority of correlations are negative implying that their concentration decreases with increasing distances. Major elements, among these are P, Ca, Mg etc. <sup>only mention the major element or all elements (odd potassium)</sup>

However, there are some exceptions such as OC, N, S, Na, Zn, and Fe whose concentration in the soil samples increase with increase in distances in all directions. <sup>Their</sup> Since ~~their~~ correlation with distance is positive and significant since the P-value is less than 0.05

**Table No.03 Pearson correlation between concentration of elements and distance**

| Elements          | Distance             |         |
|-------------------|----------------------|---------|
|                   | Pearson Correlations | p-value |
| pH                | -0.882               | 0.118   |
| EC                | -0.606               | 0.394   |
| OC                | 0.999                | 0.001   |
| N                 | 0.997                | 0.003   |
| P                 | -0.868               | 0.132   |
| K                 | -0.868               | 0.132   |
| S                 | 0.985                | 0.015   |
| Na                | 0.153                | 0.847   |
| Ca                | -0.909               | 0.091   |
| Mg                | -0.983               | 0.017   |
| Zn                | 0.889                | 0.111   |
| Fe                | 0.803                | 0.197   |
| Mn                | 0.977                | 0.023   |
| Cu                | -0.919               | 0.081   |
| CaCO <sub>3</sub> | -0.907               | 0.093   |

be consistent in numbering the tables

Potassium, Nitrogen and Sulphur were measured in high concentrations. even more than P, Ca and Mg. Include these three elements as the major ones too. Ignore the comment

This is not less than 0.05 according to the claim above. Check and correct accordingly

\* Show the equations used to determine the Pearson Correlation

Be consistent when numbering the table, use the required format from the Journal

Table 02 Physico-chemical properties of the Soils with average distance from the factory

| Elements of Soil (Units) |                | pH          | EC           | OC<br>g.kg- | N<br>Kg/ha    | P<br>Kg/ha   | K<br>Kg/ha    | S<br>Kg/ha    | Na<br>Me/100 gm | Ca<br>Me/100 gm | Mg<br>Me/100gm | Zn<br>ppm   | Fe<br>ppm    | Mn<br>ppm    | Cu<br>ppm    | CaCO <sub>3</sub><br>Me/100gm |
|--------------------------|----------------|-------------|--------------|-------------|---------------|--------------|---------------|---------------|-----------------|-----------------|----------------|-------------|--------------|--------------|--------------|-------------------------------|
| SI No                    | Directions     |             |              |             |               |              |               |               |                 |                 |                |             |              |              |              |                               |
| 01                       | SE 0.25 km     | 8.76        | 0.826        | 2.95        | 175.2         | 26.17        | 580           | 78.25         | 2.23            | 60.2            | 11.2           | 6.253       | 1.110        | 5.365        | 0.478        | 7.25                          |
| 02                       | NE 0.25 km     | 9.01        | 0.868        | 3.01        | 178.6         | 27.08        | 590           | 80            | 2.02            | 70.1            | 12.1           | 5.894       | 1.235        | 5.231        | 0.480        | 8.82                          |
| 03                       | SW 0.25 km     | 8.90        | 0.900        | 2.98        | 187           | 34.15        | 595           | 79            | 2.26            | 69.3            | 10.5           | 6.145       | 1.125        | 6.125        | 0.476        | 9.23                          |
| 04                       | NW 0.25 km     | 8.08        | 0.896        | 2.69        | 168           | 38.06        | 585           | 78            | 2.01            | 89.1            | 12.1           | 5.985       | 1.121        | 6.789        | 0.470        | 8.96                          |
| <b>Average</b>           | <b>0.25 km</b> | <b>8.68</b> | <b>0.872</b> | <b>2.90</b> | <b>177.2</b>  | <b>31.36</b> | <b>587.5</b>  | <b>78.81</b>  | <b>2.13</b>     | <b>72.17</b>    | <b>11.47</b>   | <b>6.06</b> | <b>1.396</b> | <b>5.87</b>  | <b>0.476</b> | <b>8.565</b>                  |
| 05                       | SE 0.5 km      | 8.53        | 0.557        | 3.25        | 180.1         | 15.15        | 484           | 98.21         | 1.21            | 59.3            | 9.8            | 7.213       | 1.125        | 6.013        | 0.414        | 5.15                          |
| 06                       | NE 0.5 km      | 8.08        | 0.875        | 4.23        | 189.3         | 28.15        | 580           | 95.21         | 2.01            | 68.3            | 10.3           | 6.868       | 1.258        | 6.321        | 0.344        | 7.51                          |
| 07                       | SW 0.5 km      | 7.03        | 0.557        | 3.12        | 192           | 25.15        | 584           | 86            | 2.12            | 64.2            | 9.3            | 7.148       | 1.236        | 7.154        | 0.414        | 8.12                          |
| 08                       | NW 0.5 km      | 7.5         | 0.597        | 4.12        | 196           | 37.15        | 484           | 94            | 1.92            | 70.1            | 11.5           | 6.546       | 1.563        | 7.125        | 0.412        | 8.14                          |
| <b>Average</b>           | <b>0.5 km</b>  | <b>7.78</b> | <b>0.646</b> | <b>3.68</b> | <b>189.27</b> | <b>26.48</b> | <b>533</b>    | <b>93.35</b>  | <b>1.81</b>     | <b>65.47</b>    | <b>10.22</b>   | <b>7.94</b> | <b>1.35</b>  | <b>6.653</b> | <b>0.396</b> | <b>7.23</b>                   |
| 09                       | SE 0.75 km     | 8.58        | 0.249        | 4.12        | 195.1         | 13.75        | 528           | 123.27        | 1.11            | 57.8            | 7.6            | 8.124       | 1.564        | 7.546        | 0.356        | 4.12                          |
| 10                       | NE 0.75 km     | 8.03        | 0.489        | 4.89        | 198.1         | 26.12        | 576           | 124.41        | 1.82            | 59.1            | 9.8            | 7.213       | 1.564        | 7.122        | 0.339        | 6.23                          |
| 11                       | SW 0.75 km     | 7.65        | 0.498        | 3.96        | 231           | 16.2         | 545           | 102.1         | 1.78            | 59.1            | 8.8            | 9.123       | 1.568        | 8.369        | 0.400        | 7.52                          |
| 12                       | NW 0.75 km     | 7.0         | 0.586        | 4.23        | 210           | 25.12        | 463           | 125           | 1.68            | 71.2            | 9.2            | 7.898       | 1.894        | 8.965        | 0.408        | 7.36                          |
| <b>Average</b>           | <b>0.75 km</b> | <b>7.81</b> | <b>0.911</b> | <b>4.3</b>  | <b>208</b>    | <b>20.29</b> | <b>528</b>    | <b>118.69</b> | <b>1.59</b>     | <b>61.8</b>     | <b>8.85</b>    | <b>8.08</b> | <b>1.647</b> | <b>8.005</b> | <b>0.375</b> | <b>6.24</b>                   |
| 13                       | SE 1.km        | 8.01        | 0.311        | 4.45        | 220.3         | 15.57        | 480           | 145.32        | 0.48            | 54.1            | 6.7            | 9.546       | 1.989        | 8.365        | 0.476        | 3.05                          |
| 14                       | NE 1.km        | 7.5         | 0.462        | 5.32        | 225.1         | 22.11        | 578           | 156.12        | 1.52            | 56.2            | 7.1            | 9.258       | 1.898        | 9.325        | 0.441        | 5.62                          |
| 15                       | SW 1.km        | 7.25        | 0.451        | 4.85        | 245           | 15.00        | 456           | 126           | 1.63            | 57.8            | 7.1            | 9.895       | 2.102        | 9.621        | 0.368        | 5.65                          |
| 16                       | NW 1.km        | 6.5         | 0.559        | 5.14        | 245           | 26.00        | 459           | 148           | 1.52            | 64.2            | 7.2            | 8.986       | 2.125        | 9.125        | 0.396        | 5.56                          |
| <b>Average</b>           | <b>1 km</b>    | <b>7.31</b> | <b>0.445</b> | <b>4.94</b> | <b>223.25</b> | <b>22.54</b> | <b>520.75</b> | <b>127.53</b> | <b>1.67</b>     | <b>62.05</b>    | <b>7.02</b>    | <b>8.50</b> | <b>2.02</b>  | <b>8.32</b>  | <b>0.141</b> | <b>6.41</b>                   |

Source: Lab report (This table shows the value of physicochemical properties in soil samples below 15 cm.)

If this is the work you have done, there is no need to specify it is from your laboratory report

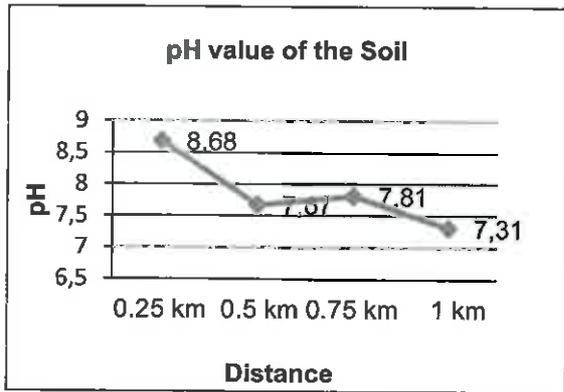


Fig .03 - caption all figures i.e. move pH value of the soil on top of the graph to this section

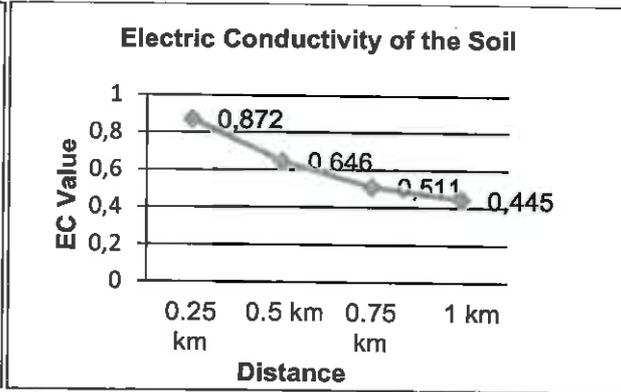


Fig .04 - See previous Comment

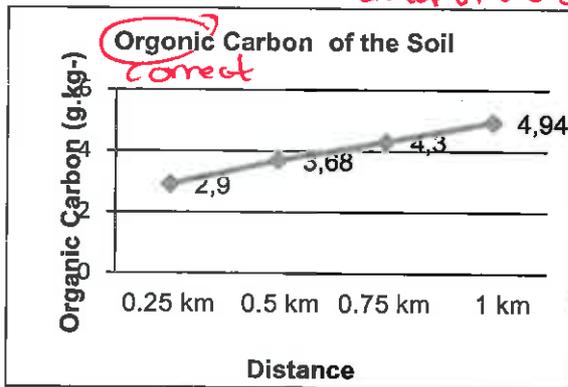


Fig .05 - see previous Comment on Fig. 3

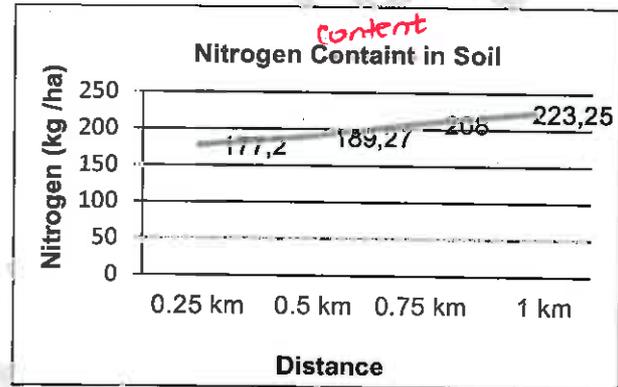


Fig .06 - see previous Comment on Fig. 3

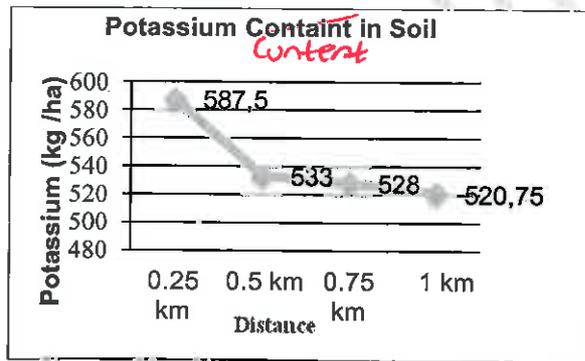


Fig .07 - see Comment on Fig. 3

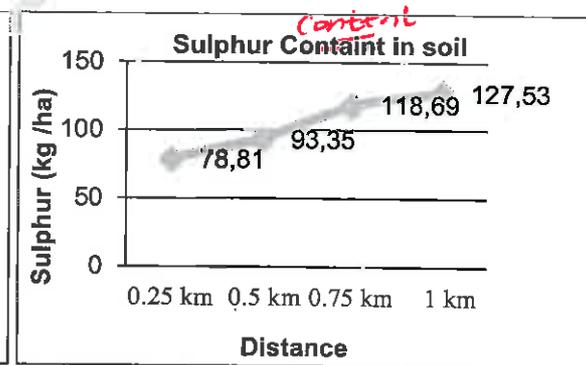


Fig .08 - See Comment on Fig. 3

Potential Hydrogen (pH) :

Statistics of the pH analysis of different soil samples are given in table no 2. The most significant when dealing with soil of the soil is its pH level. If the pH is less than 6 then it is said to be an acidic soil, the pH range from 6-7 it represents a normal soil and greater than 7 with pH the soil it is said to be alkaline soil. According to the results obtained, it varied from 7.31 to 8.68 in the samples from the



→ study area. Hence, soil was found to be alkaline type. pH values are declining with the increase of distance. *Indicating that the values declined*  
These results indicate that the soils around the cement plant were alkaline in reaction with cement dust. *This indicate*  
The soil pH was 8.68 at 0.25 km, it decreased gradually to 7.67 at 0.5 km, and it was 7.81 at 750 meter and 7.31 at 1 km, distance (Fig.1). *and The pH* There was significant decrease in the soil pH up to the increasing distance of 1 km from the cement plant. (Fig. 03)

The Pearson Correlation between pH and distance is -0.882 with a p-value of 0.118. Even though the correlation value is strong and it is negative since the p-value is greater than 0.05 we may conclude that the relation is non-significant. *Provide a reason for this conclusion*

#### Electric Conductivity (EC):

Electric Conductivity measures the ions present in solution. The electrical conductivity of soil solution increases with the increased concentration of ions. *EC is also* It is used to check the quality of soil. *The results obtained show that*  
Electric Conductivity increased from 0.445, to 0.911 at 1 km to 0.75 km distance from cement factory and 0.646 at 0.5 km and 0.872 at 0.25 km (250 meter) distance from the cement manufacturing unit, indicating the effect on soluble salt content of the soil. (Fig. 04)

The Pearson Correlation between EC and distances is -0.606 with a p-value of 0.394. Even though the correlation value is strong and it is negative. Since the p-value is greater than 0.05 we may conclude that the relation is non-significant.

#### Organic Carbon (Oc):

Soil Organic Carbon is a significant property of the soils. If the soil is deficient, *that is rich,* organic matter, it enhances the process of soil erosion. The soil is rich in organic matter is highly useful for the agricultural practices. The data clearly showed continuous decrease in organic carbon content from 4.94 (g.kg-) at 1 km distance, 4.3 (g.kg-) 750 meter, and 3.68 (g.kg-) at 500 meter and finally 2.90 (g.kg-) at 250 meter distance from the cement factory. It confirms the trend of organic carbon content in polluted area. On the basis of above results it can be concluded that the contents of cement dust highly affected the properties of soil. (Fig. 05)

The Pearson Correlation between OC and distances is 0.999 with a p-value of 0.001. Since the correlation is positive and it is significant since the p-value is 0.001 which is less than 0.05 we may conclude that there is positive and statistically significant correlation between OC and distances.

#### Nitrogen (N):

Nitrogen is a most significant manure element in the soils. Plants react quickly to use of nitrogen salts. This component encourages exceeding ground vegetation growth and gives a deep green color to the leaves. It is the most essential nutrient required by plant for proper growth and development.

The result <sup>showed</sup> shows that, the availability of Nitrogen in collected soil is 223.25 kg /hectare at the distance of 1 km from the cement industry and its continuously decreasing 208 kg /hectare at 750 meter, 189.27 kg /hectare at 500 meter and finally 177 .2 kg /hectare 250 meter at the distance from the cement factory. It showed a clear trend of reduction in total Nitrogen content in soil with decreasing distance. (Fig. 06)

The Pearson Correlation between N and distances is 0.997 with a p-value of 0.003. Since the correlation is positive and it is significant since the p-value is 0.003 which is less than 0.05. We may conclude that there is positive and statistically significant correlation between N and distances. This implies that as the distance from cement factory increases the concentration of N in soil samples also increases.

#### Potassium (K):

Potassium is also one of the major elements in plants components and it is useful for growth of <sup>the</sup> every plants. The normal preparation of potassium in soils is 110 kg/ha to 280 kg/ha. But more concentration of potassium content <sup>was detected</sup> found near the cement industry because of cement dust. <sup>check if it is not meant to be content.</sup> <sup>factory</sup> - Refer to the source

<sup>The</sup> Here ~~the~~ total potassium content of the soil is 520.75 kg/hectare at 1 km distance from the cement factory and <sup>an</sup> increasing trend <sup>P was found to be</sup> were continued, like 528 kg/hectare at 750 meter and 533 kg/hectare at 0.5 km and finally ~~near the factory means at the distance of 0.25 km high potassium were found~~ 587.5 kg/hectare because of cement dust. (Fig. 07)

<sup>nearest to the factory</sup>

The Correlation between K and distances from the factory is -0.868 with a p-value of 0.132. Even though the correlation value is strong and it is negative. Since the p-value is greater than 0.05. Thus, the relation is non-significant.

#### Sulphur (S):

The Normal Range of sulphur content in soil is 20 kg/hectare to 40 kg/hectare. Here the samples of soil in the study area show the high sulphur content and we have seen high concentration of sulphur in soils and its increasing trend with increasing distance from the factory.

At the distance of 0.25 km sulphur content of soils <sup>was</sup> 78.81 kg/hectare and its increases to 93.35 kg/hectare at 0.5 km distance, and 118.69 kg/hectare and 127.53 kg / hectare at the distance of 0.75 km and 1 km distance, respectively from the cement factory. (Fig. 08)

The Correlation between Sulphur and distances from the factory is 0.935 with a p-value of 0.015. Since the correlation is positive and it is significant since the p-value is 0.001 which is less than 0.05 we may conclude that there is positive and statistically significant correlation between concentration of Sulphur in the soil samples and distances.

#### Sodium (Na):

The Normal Range of sodium content in the soil is 1.00 me/100gm to 1.5 me/100gm (milli equivalents per 100 gram). As ~~per the lab report~~, soils of the study area <sup>is laden with</sup> have more sodium content compared to the normal range of sodium content in soils.

Sodium content of soils in the study area <sup>was</sup> has 2.13 me/100gm at the distance of 0.25 km. <sup>It has</sup> showing a higher concentration of sodium near <sup>at</sup> the cement factory. ~~And its goes on decreasing with the increasing distance.~~ At the distance of 0.5 km and 0.75 km the concentration of sodium <sup>was</sup> is 1.81 me/100gm and 1.59 me/100gm respectively. (Fig. 09) Correlation between concentration of Na in the soil samples and distances from the factory is 0.153 with a p-value of 0.847. Even though the correlation value is strong and it is positive as the relationship is non-significant.

The value is not what is presented in Fig. 9. Please check and correct is it 1.59 me/100gm or 5.13 me/100gm.

State the reason for non-significance

Reference

Reference

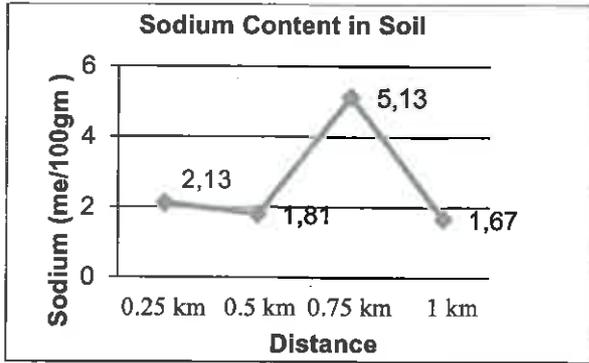


Fig. 09 - See comment on fig 3.

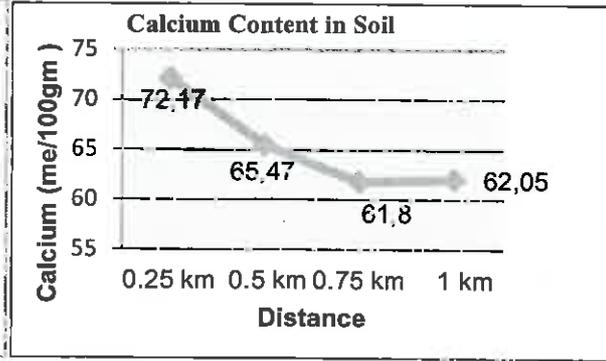


Fig. 10 - See comment on fig 3

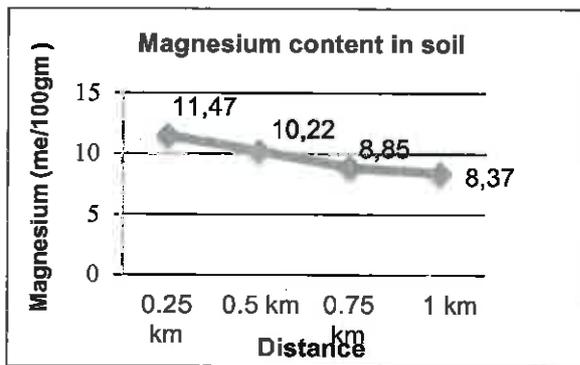


Fig.11 - see comment on fig 3

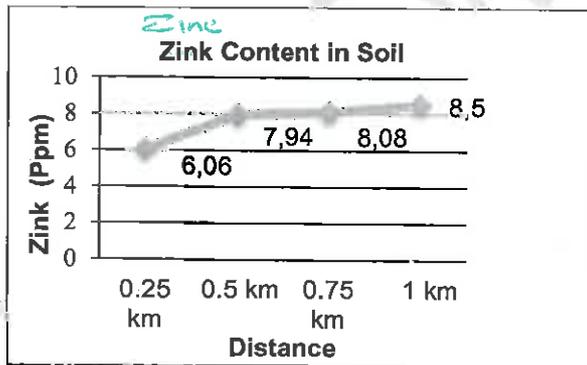


Fig.12 - See comment on fig 3

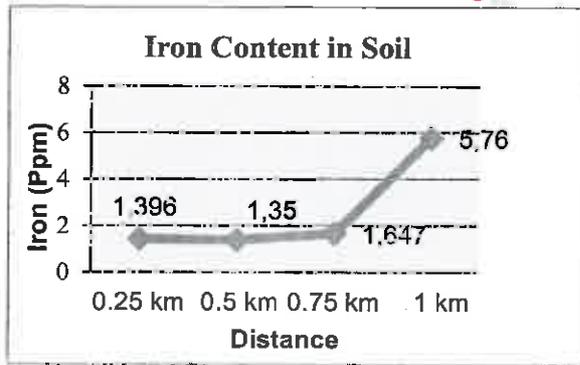


Fig.13 - See comment on figure 3

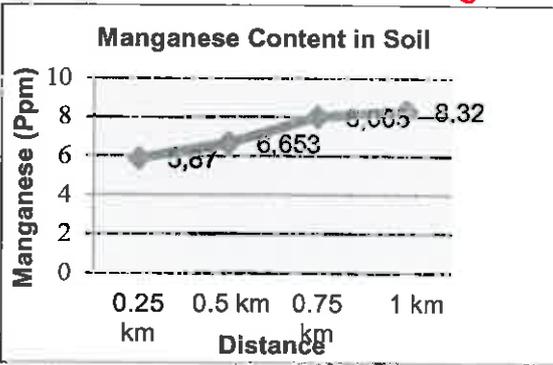


Fig.14 - See comment on fig 3

Zink (Zn):

Zink is one of the major micronutrient elements in soils, it is play vital role in plants growth. In the study area soils are having sufficient Zink content. But the soils have lost concentration of Zink near the cement industry. The normal range of Zink content in soils is 0.6 ppm to 6.5 ppm. Ppm (Parts per million).

### Calcium (Ca):

Reference like source  
Normally concentration of calcium in the soil ranges from 10 to 30 me/100gm (milli equivalents per 100 gram). Calcium content in soils near the factory is showing high concentration because of cement dust and its continuously decreasing away from cement factory. At the distance of 0.25 km calcium content is 72.17 me/100gm. 65.47 me/100gm calcium content is found at the distance of 0.5 km. At the distance of 0.75 km and 1 km from cement factory calcium content of soils is 61.8 me/100gm and 62.05 me/100gm respectively. (Fig. 10)

Correlation between concentration of Ca in soil samples and distances from the factory is -0.909 with a p-value of 0.091. This indicates that the relationship is non-significant.

### Magnesium (Mg):

The magnesium content of soils in the study area is having more concentration of magnesium compare to normal range of magnesium content in soils. The normal range of magnesium content in soils is 3 to 10 me/100gm. In study area at the distance of 0.25 km from the cement factory the concentration of magnesium is 11.47 me/100gm and 10.22 me/100gm at the distance of 0.5 km, 8.85 me/100gm and 8.37 me/100gm at the distance of 0.75 and 1 km distance from cement factory respectively. (Fig. 11)

Correlation between concentration of Mg in soil samples and distances from the factory is -0.983 with a p-value of 0.017. Since the correlation is positive and it is significant since the p-value is 0.001 which makes it clear that there is negative and statistically significant correlation between concentration of magnesium in the soil samples and distances. This implies that as the distance from cement factory increase the concentration of Mg in soil samples decreases.

## Zinc (Zn)

The Zinc content of soils in study area is 6.06 ppm at the distance of 0.25 km from the cement factory. Here it is showing increasing trend with increasing distance from cement factory. At the distance 0.5 km the concentration of Zinc is 7.94 ppm and 8.08 ppm at the distance of 0.75 km. Finally the concentration of Zinc content in soils is 8.50 ppm at the distance of 1 km from factory. (Fig. 12)

Correlation between concentration of Zn in the soil samples and distances from the factory is 0.889 with a p-value of 0.111. Though the correlation value is strong and it is positive as the p-value is greater than 0.05 the relationship is non-significant.

## Iron (Fe):

Ferrous content is one of most essential micronutrient element for plant development. The moderate concentration of iron is good for plants but the study area soils have lesser concentration of iron. If the concentration of iron in soils less than 2.5 ppm, they are called as Non Calcareous soils and if its concentration is more than 4.5 ppm, they are called Calcareous soils.

The study area has Non Calcareous soils as its concentration of iron is 1.396 ppm at the near the factory 0.25 km distance. At the distance of 0.5 km and 0.75 km the concentration of iron is 1.35 ppm and 1.647 ppm respectively, and finally the concentration of iron in soils is increasing suddenly as 5.76 ppm at the distance of 1 km from cement industry. Correlation between concentration of Fe in the soil samples and distances from the factory is 0.803 with a p-value of 0.197. This is also showing non-significant relationship. (Fig. 13)

## Manganese (Mn):

Manganese is also one of the major micronutrients in the soil. The soils which have 28.46 ppm are better for growth and development of plants. But the concentration of manganese is lower in the soils of the study area.

The manganese concentration of soils is 5.87 ppm at the distance of 0.25 km from the factory and its concentration increases away from the cement industry. At the distance of 0.5 km and 0.75 km the concentration of manganese in soils is 6.653 ppm and 8.005 ppm respectively and 8.32 ppm respectively.

concentration of manganese in soils is found at the distance of 1 km from the factory. This implies that as the distance from cement factory increases the concentration of Mn in soil samples also increases (Fig. 14),

but the increment in the concentration was not sufficient to reach the required concentrations of 28.46 ppm.

Correlation between concentration of manganese in soil samples and distances from the factory is 0.977 with a p-value of 0.023. Since the correlation is positive and it is significant since the p-value is 0.023 which is less than 0.05 which shows positive and statistically significant correlation.

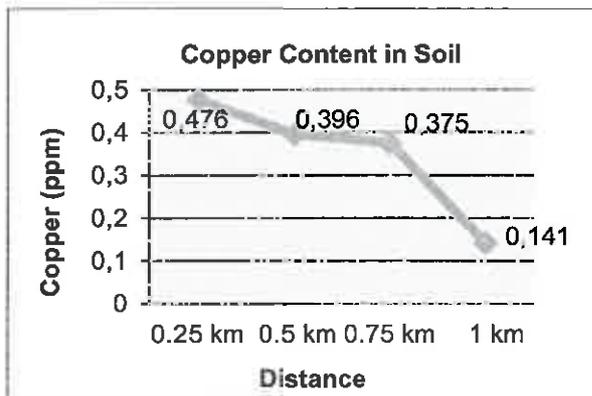


Fig.15

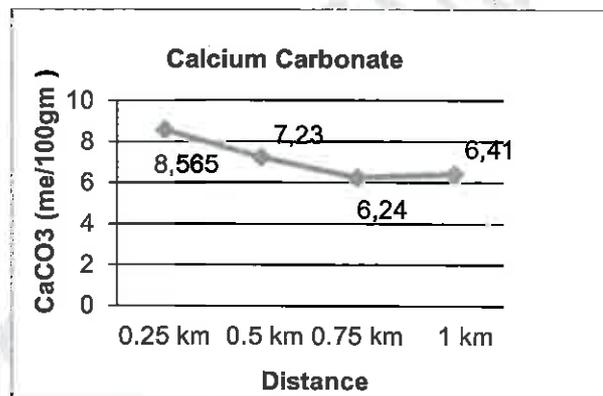


Fig.16

#### Copper (Cu):

Copper is also one of the essential micronutrients of soils like Zn, Fe, Mn. The concentration of copper in study area soils is 0.476 ppm at the distance of 0.25 km from cement factory. At the distance of 0.5 km and 0.75 km from the cement industry the concentration of copper in soils is 0.396 ppm and 0.375 ppm respectively and finally 0.141 ppm concentration of copper found at the distance of 1 km from cement industry. Thus, it goes on decreasing away from the factory. (Fig. 15) Thus showing a decreasing trend as the distance is further from the factory.

Correlation between concentration of Cu in soil samples and distances from the factory is -0.919 with a p-value of 0.081. This shows non-significant relationship.

#### Calcium Carbonate (CaCO<sub>3</sub>):

Calcium Carbonate is one of the most important elements in soils, it is essential for every plant. But high concentration of Calcium Carbonate in soils results into alkaline soils. Its maximum

Like Zn, Fe and Mn

Reference to survey

The

concentration is found near the factory due to fall of dust on soils. At the distance of 0.25 km the concentration of  $\text{CaCO}_3$  is 8.56 me/100gm (milli equivalents per 100 gram), 7.23 me/100gm and 6.24 me/100gm concentration of  $\text{CaCO}_3$  is found at the distance of 0.5km and 0.75 km from the cement industry respectively. And 6.41 me/100gm concentration of  $\text{CaCO}_3$  is found at the distance of 1 km from cement factory. It shows that concentration of calcium carbonates decreases with increasing distance. (Fig. 16)

Correlation between concentration of  $\text{CaCO}_3$  in soil samples and distances from the factory is 0.907 with a p-value of 0.093. This is also showing non-significant relationship.

## Conclusion

In the present study, it has been established that the physico-chemical properties of the soils around the factory have been changed due to the dust deposition as it is adversely affecting the composition soils. This in turn affecting the concentration of nutrients required for plants growth. Further, it may become hazardous to soil, flora and fauna. As such, the factory management has not initiated any measures to reduce the dust emission. Therefore, government has to take proper action against the factory which may force the management to make efforts to minimise the dust emission. Further, people living around the factory have to be educated about effects of dust deposition on their fields and houses so that they could be cautious about it.

## 6. References

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3. Mlitan, A. B., Alajtal, A. I., & Alsadawy., A. M. (2013). Toxicity of Heavy Metals and Microbial Analysis of Soil Samples Collected from the Area around Zliten Cement Factory. Open Journal of Air Pollution, 2, 25-28.

4. Okoro H K, Orimolade B O, Adebayo G B, Akande B A. An Assessment of Heavy Metals Contents in the Soil around a Cement Factory in Ewekoro, Nigeria Using Pollution Indices. Pol. J. Environ. Stud. 2017;26 (1): 221-228.
5. Khamparia A, Chatterjee S K, Shirma G D. Assessment on Effect of Cement Dust Pollution on Soil Health. JERD. 2012; 7 (1A): 368-374.

### Conclusion Section :

The conclusion section should be expanded and focus more on the results obtained. Include a statistical summary on the findings.

### Results and Discussion Section :

The results are well presented but the authors should include other research findings from other researchers to support their findings.

### Introduction Section :

The introduction is not enough and the authors should include more literature review on the similar studies conducted by other researchers. Also check the consistency under the introduction.

Figures : Figures should be explained correctly. The graph title on the top legend of the presented graphs should be removed and be placed as figure caption.

Tables : The numbering of tables is inconsistent and the authors should correct accordingly.