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ASSESSMENT OF SOIL QUALITY NEAR A CEMENT INDUSTRY

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ABSTRACT

Industrialization and urbanization is reducing the cultivable land at a faster rate. at one side there is a growing demand of crops and vegetables for growing population , which require more land available for the cultivation , on the other side , the same population requires land for making homes, schools and industries to fulfill their other requirements. Man has already realized the adverse use of fertilizers to get more and more crops from the same land. In India after so much cry about the industrial pollution, industries were pushed back to rural areas to avoid the pollution problems to the congested urban population. Industries shifted in the rural areas emitting all types of pollution deteriorating the surrounding environment. Soil quality is also degrading because of pollution from air and water discharge, even farmers starts complaining about the reduction in crops yield because of poor quality of soil. In this paper an attempt has been made to identify the impact of Cement Industry on the surrounding environment mainly on the soil quality. This study is a part of a comparative EIA report, so importance of using the high efficiency ESP's and other control equipment to avoid or reduce the pollution is also studied.

INTRODUCTION

Soil may be defined as a thin top layer of earth's crust, which serves as a natural medium for the growth of plants.

Unconsolidated mineral matter has been subjected to and influenced by environmental factors such as parent materials, climate, organism and physio-chemical action of wind, water and sunlight, all acting over a period of time. Soil differs from parent materials in the morphological, physical and chemical properties.

- Study for impact assessment due to atmospheric pollution on the ecosystem has been demonstrated number of times.
- This type of pollution is caused industrial activities and cement industry is one of them. The main impact of cement industry is because of particulate matter and gaseous pollutants. The particulate matter are having different diameter and they are at the mercy of atmosphere.
- The atmospheric particles can have as consequence the reduction of biodiversity and quality of products. The main visible pollutants generated by cement industry is particulate matter which is generated throughout the manufacturing process right from extraction of raw material to packing of finished product. It is important to understand that presence of sulfur dioxide in the soil may be entropic origin ,

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that may be because of combustion of the fossil fuels (coke or oil) consumed by the industry and resulting the generation of sulfur dioxide.

- The particles that are generated from the cement industry can enter into the soil as dry, humid or occult deposits and may have impact on its physiochemical properties.

Study area -An overview

Soil Environment : The topography of the area is undulating. It is a dotted terrain, which consists of small hills, plains and small valleys forming a part of Vidhyan and Conjure plateau.

The thickness of soil layers on hillocks and plains were observed to be different, as it varies from 0 - 50 cm on hillocks showing a shallow thickness and from 50 - 250 cm on plains with a relatively high thickness. By nature, soil in the area is found to be rich in organic matter due to regular deposition of humus and soil layer due to erosion.

MATERIALS AND METHODS

Soil sampling location in the study area

To analyze the soil quality of the study area soil samples were collected from three different locations in the vicinity of cement plant. The samples were collected once in every season, from all the three locations, for entire study period of one year. The locations selected for the monitoring were same on which bases earlier study was done. So by analyzing the soil quality we could observe the changes in the soil in the span of 6 years period. The spatial information about soil properties is essential for effective and sustainable soil protection (Zerrouqi, 2008).

RESULTS AND DISCUSSIONS

Each of the soil sample collected for the study area was analyzed for 18 parameters. The season wise soil quality results are mentioned in Tables 1 to 4 From the results obtained, following observation can be made.

pH of soil varied from a maximum of 8.25 to a minimum of 8.8, which shows that the soil is alkaline in nature.

Color of soil is yellowish grey at location A and B , where as grey at location C. This indicates the suitability of soil for agriculture purpose.

Porosity of soil varied from a maximum of 59% to a minimum of 48.5%. This shows that the soil has about 41 % of water percolating capacity.

Conductivity showed the concentration of electrolyte in the soil. It was found varying from a maximum of 0.85 mhos/cm to a minimum of 0. 1 82 mhos /cm.

Water holding capacity exhibited the capacity of soil to hold water. Percentage water holding capacity of soil was found less as it varied from a maximum of 46% to a minimum of 31%.

Nitrogen, Phosphorus, Potassium and iron were present in significant quantity. Soil showed that soil of the area lacked manure, thus it was not a much fertile soil for the crops.

Keeping in view the above observations, it can be clearly stated that the soil had been moderate in nature.

Table 1. Soil quality in the study area (Season-monsoon)

S.N.	Parameters	A	B	C
1.	pH Value	8.22	7.9	7.8
2.	Conductivity at 250 C (milli mhos/cm)	0.59	0.51	0.542
3.	Color	Yellowish Grey	Yellowish Grey	Yellowish Grey
4.	Porasity (%)	57.0	47.51	59.0
5.	Water Holding Capacity(%)	31.0	39.91	41.25
6.	Sodium as Na (meq/100gm)	0.6	0.25	37.0
7.	Potassium as K (meq/100 gm)	0.24	2.0	0.7
8.	Calcium as Ca (meq/100)	2.65	10.8	6.0
9.	Maganisum as Mg (meq/100 gm)	0.7	4.0	0.9
10.	Available Iron (ppm)	32.5	12.5	18.5
11.	Manganese (as Mn)	N.D	N.D	N.D
12.	Chloride as Cl (meq/100 gm)	0.12	0.32	0.36
13.	Sulfates as SO_4 (meq/100 gm)	0.05	0.07	0.068
14.	Bicarbonates (meq/100 gm)	6.0	7.1	7.0
15.	Carbonates	N.D	N.D	N.D
16.	Phosphates as P (ppm)	40.0	130.0	26.0
17.	TKN (%)	0.083	0.088	0.138
18.	CEC (meq/100 gm)	6.0	17.2	6.9

N.D=Not detectable

Table 2. Soil quality in the study area (Season-Post-monsoon)

S.N.	Parameters	A	B	C
1.	pH Value	8.15	7.9	8.1
2.	Conductivity at 25 ^{0}C (milli mhos/cm)	0.182	0.65	0.74
3.	Color	Yellowish Grey	Yellowish Grey	Grey
4.	Porasity (%)	55.0	48.9	58.0
5.	Water Holding Capacity(%)	32.0	39.00	41.0
6.	Sodium as Na (meq/100gm)	0.6	0.8	0.4
7.	Potassium as K (meq/100 gm)	1.2	0.78	0.5
8.	Calcium as Ca (meq/100)	1.85	2.9	0.8
9.	Maganisum as Mg (meq/100 gm)	1.0	0.5	0.7
10.	Available Iron (ppm)	9.8	5.15	62.5
11.	Manganese (as Mn)	N.D	N.D	N.D
12.	Chloride as Cl (meq/100 gm)	0.11	0.29	0.25
13.	Sulfates as SO_4 (meq/100 gm)	0.05	0.08	0.01
14.	Bicarbonates (meq/100 gm)	7.0	16.8	5.9
15.	Carbonates	N.D	N.D	N.D
16.	Phosphates as P (ppm)	15.0	270.0	140.0
17.	TKN (%)	0.08	0.24	0.09
18.	CEC (meq/100 gm)	39.9	54.6	76.2

N.D=Not detectable

Table 3. Soil quality in the study area (Season - Winter)

S.N.	Parameters	A	B	C
1.	pH Value	8.25	8.1	8.2
2.	Conductivity at 250 C (milli mhos/cm)	0.23	0.35	0.75
3.	Color	Yellowish Grey	Yellowish Grey	Grey
4.	Porasity (%)	58.0	56.0	58.0
5.	Water Holding Capacity(%)	39.0	38.0	41.0
6.	Sodium as Na (meq/100gm)	0.82	1.1	0.51
7.	Potassium as K (meq/100 gm)	1.2	0.9	1.88
8.	Calcium as Ca (meq/100)	2.4	3.2	3.96
9.	Maganisum as Mg (meq/100 gm)	1.1	0.9	0.88
10.	Available Iron (ppm)	9.2	6.0	54.0
11.	Manganese (as Mn)	N.D	N.D	N.D
12.	Chloride as Cl (meq/100 gm)	0.4	0.5	0.3
13.	Sulfates as SO_4 (meq/100 gm)	0.017	0.03	0.07
14.	Bicarbonates (meq/100 gm)	5.1	5.4	7.1
15.	Carbonates	N.D	N.D	N.D
16.	Phosphates as P (ppm)	17	280.0	150.0
17.	TKN (%)	0.09	0.28	0.09
18.	CEC (meq/100 gm)	37.2	42.4	42.4

N.D=Not detectable

Table 4. Soil quality in the study area (Season - Summer)

Comparison with Previous Results

The aim of the present study has been to assess the change in the soil quality from the previous study results. The average results for this entire previous study period are mentioned in Table 5 where as the

S.N.	Parameters	A	B	C
1.	pH Value	8.22	7.95	8.05
2.	Conductivity at 25^{0}C (milli mhos/cm)	0.34	0.45	0.62
3.	Color	Yellowish Grey	Yellowish Grey	Yellowish Grey
4.	Porasity (%)	56.25	50.35	58.25
5.	Water Holding Capacity(%)	35.25	39.73	41.25
6.	Sodium as Na (meq/100gm)	0.58	0.71	0.65
7.	Potassium as K (meq/100 gm)	0.88	1.19	0.89
8.	Calcium as Ca (meq/100)	2.37	4.69	3.54
9.	Maganisum as Mg (meq/100 gm)	0.94	1.51	0.79
10.	Available Iron (ppm)	14.88	6.98	41.75
11.	Manganese (as Mn)	N.D	N.D	N.D
12.	Chloride as Cl (meq/100 gm)	0.38	0.32	0.38
13.	Sulfates as SO_4 (meq/100 gm)	0.05	0.06	0.11
14.	Bicarbonates (meq/100 gm)	6.15	6.65	6.15
15.	Carbonates	N.D	N.D	N.D
16.	Phosphates as P (ppm)	23.75	192.25	102.75
17.	TKN (%)	0.08	0.17	0.10
18.	CEC (meq/100 gm)	24.90	48.20	44.92

N.D=Not detectable

Table 5. Average soil quality in the study area (Year-1993-94)

S.N.	Parameters	A	B	C
1.	pH Value	8.0	7.90	7.90
2.	Conductivity at 250 C (milli mhos/cm)	0.33	0.32	0.31
3.	Color	Yellowish Grey	Grey	Yellowish Grey
4.	Porasity (%)	49.25	53.25	53.50
5.	Water Holding Capacity(%)	32.75	36.25	35.25
6.	Sodium as Na (meq/100gm)	0.62	0.89	0.56
7.	Potassium as K (meq/100 gm)	0.82	1.00	1.69
8.	Calcium as Ca (meq/100)	4.90	4.90	4.75
9.	Maganisum as Mg (meq/100 gm)	1.20	1.55	0.90
10.	Available Iron (ppm)	18.37	20.83	10.37
11.	Manganese (as Mn)	N.D	N.D	N.D
12.	Chloride as Cl (meq/100 gm)	0.27	0.39	0.30
13.	Sulfates as SO4 (meq/100 gm)	0.02	0.04	0.065
14.	Bicarbonates (meq/100 gm)	3.75	4.06	5.20
15.	Carbonates	N.D	N.D	N.D
16.	Phosphates as P (ppm)	47.50	17.75	27.00
17.	TKN (%)	6.25	5.75	8.00
18.	CEC (meq/100 gm)	8.75	9.25	8.25

N.D=Not detectable

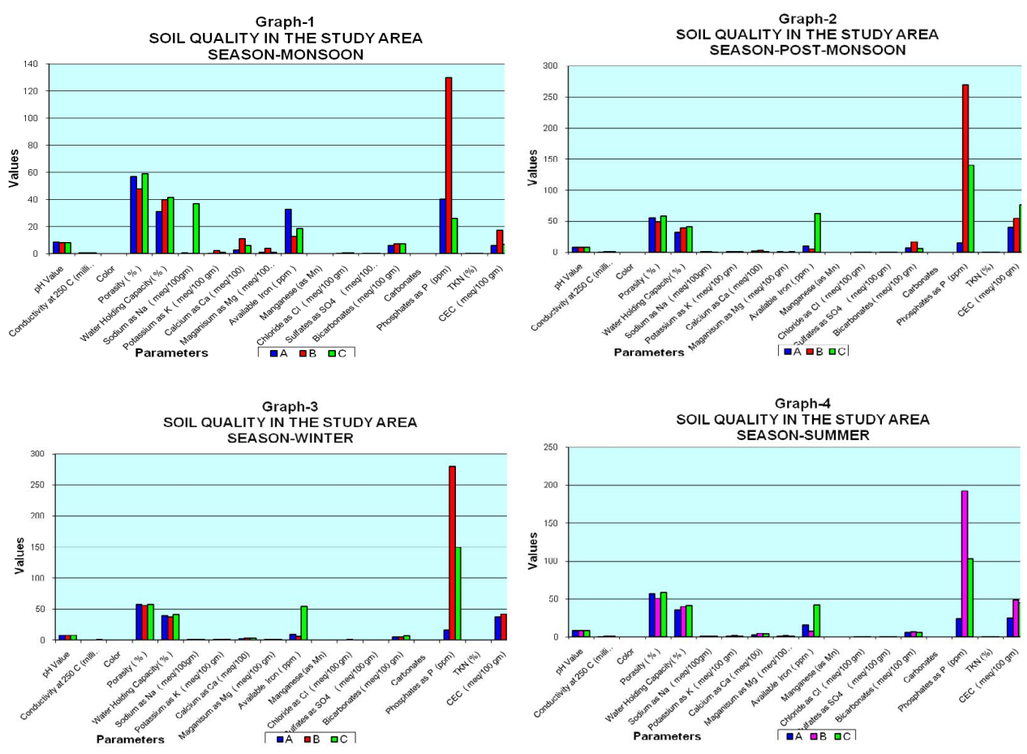
Table 6. Average soil quality in the study area (Year-1998-99)

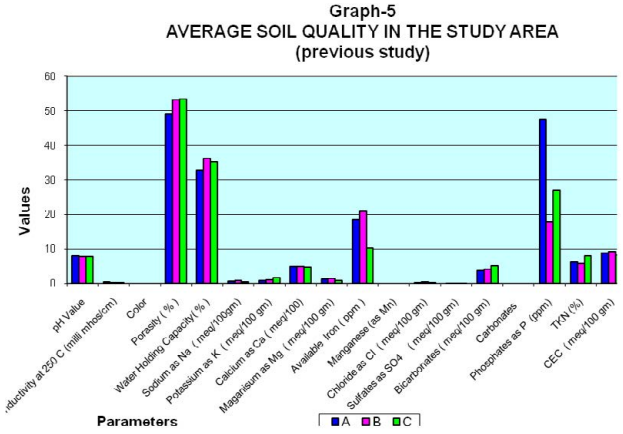
average results obtained for current study are mentioned in Table 6.

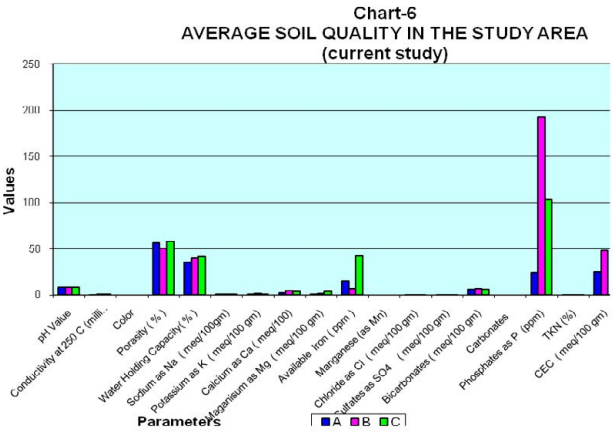
From these Tables, comparison graphs are drawn for all the three locations, i.e. A, B & C. These graphs are enclosed as Graph 1- 6. From these graphs and tables, it is clear that for most of the parameters like pH, conductivity, porosity, water holding capacity, calcium etc. results obtained for the previous study and latest studies are almost the same. However variation has also been observed for few parameters

S.N.	Parameters	A	B	C
1.	pH Value	8.22	7.95	8.05
2.	Conductivity at 25 ^{0}C (milli mhos/cm)	0.34	0.45	0.62
3.	Color	Yellowish Grey	Yellowish Grey	Grey
4.	Porasity (%)	56.25	50.35	58.25
5.	Water Holding Capacity(%)	35.25	39.73	41.25
6.	Sodium as Na (meq/100gm)	0.58	0.71	0.65
7.	Potassium as K (meq/100 gm)	0.88	1.19	0.81
8.	Calcium as Ca (meq/100)	2.37	4.69	3.54
9.	Maganisum as Mg (meq/100 gm)	0.94	1.51	3.79
10.	Available Iron (ppm)	14.88	6.98	41.75
11.	Manganese (as Mn)	N.D	N.D	N.D
12.	Chloride as Cl (meq/100 gm)	0.38	0.32	0.38
13.	Sulfates as SO_4 (meq/100 gm)	0.05	0.06	0.11
14.	Bicarbonates (meq/100 gm)	6.15	6.65	6.15
15.	Carbonates	N.D	N.D	N.D
16.	Phosphates as P (ppm)	23.75	192.25	102.75
17.	TKN (%)	0.08	0.17	0.10
18.	CEC (meq/100 gm)	24.90	48.20	0.10

N.D = Not detectable







i.e. Total iron, Phosphates and CEC.

In this particular study data for all the control equipment for source emission was also collected. All the point sources are equipped with Modern electrostatic precipitator and bag collector , which are giving efficiency as high as 99.99% and because of this the impact on the surrounding is quite less.

In view of above observations it can be stated that the soil quality of the area in the vicinity of cement plant had some adverse impact due to the operation of the plant but at the same time because of good environmental management systems effects are on the lower side.

CONCLUSION

The results of the present study and its comparison of the previous study are clear indication of a good environmental management systems adopted by the cement industry. Results are more or less similar to the previous study results and concludes that industry are the requirement for the development and progress of the country, use of best available control technologies gives options to control the harmful pollutants at their minimal level.

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