

Impact of cement dust on chemical properties of soil in Khrew industrial area, Jammu and Kashmir, India

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Abstract—The present study was carried out to assess the effect of cement dust deposition on the chemical properties of soil in the vicinity of Khrew Industrial area Jammu and Kashmir. Soil samples were collected and analyzed and compared with control site and standard soil classification. Comparison of soil chemical parameters revealed that cement dust from factory effect the soil quality surrounding cement factory. Soil organic carbon and was in medium range.

Exchangeable Calcium, Total phosphorus, Exchangeable Magnesium was also high in affected range than the control site. At present it may not be that serious but if this trend continues soil properties of a vast area is likely to be change indirectly affecting flora, fauna, and human being.

The present study was conducted to assess the soil chemical properties and effect of cement dust on the soil quality in the surroundings area of the Khrew Industrial area Jammu and Kashmir. Assessment of chemical properties of soil leads to the managing of resources while working with soil of a region. The specific analysis of this factor and different parameters testing related to this study is much needed to check the effects of cement dust from factory on soil because soil is our life-supporting system and plays a vital role in the earth's ecosystem. Besides all the goodness, the soil quality is degrading day-by-day due to rapid urban-industrial growth and improper use and management of soil.

Keywords – Chemical properties, soil quality, cement dust, life-supporting system

I. INTRODUCTION

The soil is a complex organization being made up of some six constituents, namely organic matter, inorganic matter, soil organisms, soil moisture, soil solution and soil air. Roughly the soil contains 50-60 % mineral matter, 25-35 % water, 15-25 % air and little percentage of organic matter (Chatwalet al .2005). Rapid industrialization and addition of the toxic substances to the environment are responsible for altering the ecosystems (Mudd & Kozlowski,

1975; Niragau & Davidson, 1986; Clayton & Clayton, 1982). Different industrial activities are degrading various environmental components like water, air, soil and vegetation (Sai et al., 1987; Mishra, 1991; Murugesan et al., 2004; Kumar et al., 2008). Environmental stress, such as air pollution, is among the factors most limiting plant productivity and survivorship (Woo et al., 2007). The fast industrial growth is causing enormous environmental pollution problems and affecting distribution of plants and soil characteristics of the area. Industrial pollution is caused by the discharges of varieties of industrial pollutants in the forms of gases, liquids and solids which affect the physical, chemical and biological conditions of the environment and are detrimental to human health, fauna, flora and soil properties (Dueck & Eendenijk, 1987). Environmental contamination due to dust particle coming from Cement Industries, Coal Mining, Quarrying, Stone Crushing, Thermal power Plant etc., has drawn much attention of the environmental scientists today as they create serious pollution problems and pose threat to the ecosystems. Khrew area of Kashmir valley is biodiversity rich area and this place is now known as cement industrial area .The cement factories ,saffron growing by the farmers and the business of saffron ,almonds and walnuts are the main economic drivers of Khrew .The cement industry has generated good employment In the area but at the same time due to Air pollution by cement factories ,there has been considerable decline in production of walnuts , almonds , saffron and other crops .Jammu and Kashmir Ltd.,with daily production of 600 tons and now 1200 tons ,was set up at Khrew. Cement dust from the cement plants forming a thin layer is deposited over the adjacent agricultural fields. The cement dust contains different particulate pollutants which affect vegetation,soil microbial population and other properties (Iqbal and Shafiq, 2001).

II. STUDY AREA

Khrew is a town and a notified area committee in Pulwama district of J&K. Khrew is contributing 840 cores per annum to the state economy after Jammu and Kashmir Bank LTD. Khrew is located at 34° 01' N 74° 59' E, 34° 02' N 74° 98' E. It has an average elevation of 1607 meters (5272 feet). As per census of 2014, Khrew had a population of 18411. It is surrounded on all sides by small villages known as Androssa, Shar-e-Shali, Wuyan, Bathen, Nagandar, Wahabsobun etc. Accordingly three sites were designated for the present study:

SITE I -: this was adjacent to cement factory in the south –eastern direction and was in receipt of heaviest dust pollution.

SITE-II-: this was located few meters away from the cement factory towards its south eastern side and it was also in the receipt of heavy cement dust.

SITE-III-: this was situated very close to pampore town and represented the control site. This site was about 3 km away from the cement factory.

III. METHODOLOGY

Soil chemical characteristics were determined by collecting composite surface (0-10 cm depth) soil samples with the help of a soil core from the four sites in order to give due representation to the microenvironment at each site. Soil samples were stored in airtight polythene bags for subsequent laboratory investigations. The samples were air-dried, crushed using a pestle and mortar and passed through 2mm sieve before laboratory analysis (Ghosh & Kundun, 1991). Moisture content was determined following Michael (1984). 50 g of soil sample was dried in an oven at 105 °C for 24 hours till constant weight was obtained. The soil was then allowed to cool in a desiccator and weighed again to find out the loss in weight. The loss in weight corresponds to the amount of water present in the soil sample. Percent moisture content of soil was calculated by the following formula: $(\text{loss in weight}/\text{initial weight}) \times 100$. The organic carbon and organic matter percentage were determined by rapid titration method (Walkley & Black, 1934). Loss on ignition (%) was determined by the muffle furnace method (Hanna, 1964), the muffle furnace (Model: Instron IN 301) temperature was maintained at 700 °C for half an hour. Calcium carbonate was determined by the titration method (Rowell, 1994). Chloride was estimated by titrating the extracts of soil samples with AgNO₃ as prescribed by Richards (1954). Exchangeable calcium and magnesium were

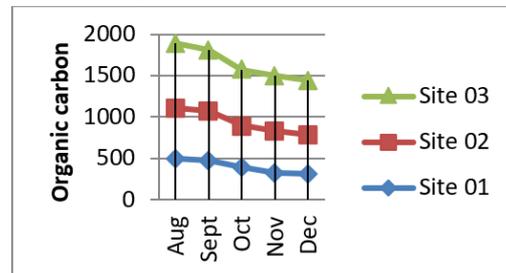
estimated in 1N ammonium acetate – shaking and filtration method (Schollenberger and Simon, 1945) followed by titration with EDTA. Exchangeable sodium and potassium in soil was determined according to Richards (1954). Available phosphorous was estimated by Watanabe and Olsen, 1965 and the measurements of absorbance were carried out at 882 nm on a spectrophotometer (Model: Elico SL 171 Mini Spec; Hyderabad, India).

IV. RESULTS AND DISCUSSION

The results pertaining to present investigation entitled, “Impact of cement dust on chemical parameters of different soils in Khrew area of Pulwama are represented as under

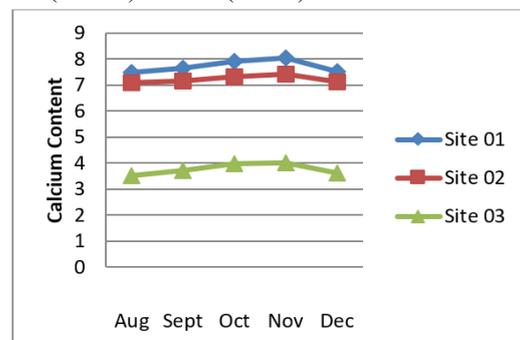
Organic carbon

Organic carbon content was found to vary respectively between 0.36% at site 1 in the month of August and maximum was found at 0.91% at site 3 in the month of October. The mean organic matter during the present study for the three sites were 0.40% at site 1, 0.46% at site 2 and 0.87% at site 3.



Exchangeable calcium

During the present study the exchangeable calcium content was found to vary between a maximum 8.03 me/100g at site 01 in the month of November to a minimum 3.5 me/100g at site 03 in the month of August. The values of calcium ranged from (site 01), 7.22 (site 02) to 3.77 (site 03).

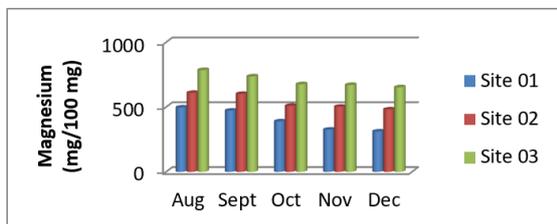


Exchangeable magnesium

The exchangeable magnesium content was found to be highest in the month of November at site 1

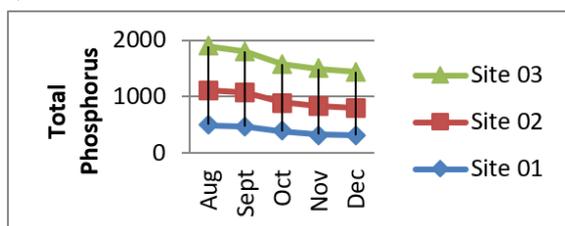
(5.04me/100g) and lowest at site 3 in the month of August (1.50me/100g). The mean magnesium content (me/100) varied between 4.7(site 1) 4.2 (site 2) and 1.7 (Site 3).

Table3: Monthly variation of exchangeable magnesium (me/100g) at different site



Total Phosphorus

During the present study the phosphorus depicted a progressively decreasing trend as the season shifted towards colder weather with a maximum value of 785ug/g recorded at site 3 in the month of August and the minimum value of 3.11ug/g found at site 1 in the month of December. The mean value ranged from 337ug/g (site 1), 540ug/g (site 2) and 703ug/g (site 3).



Organic carbon in a soil is regarded as an index of its fertility status and is used for evaluating the nitrogen supplying capacity of soil. Organic carbon is contained in the soil organic fraction, which consists of cells of microorganism, plant and animal residue at various stages of decomposition and stable humus synthesized from residues. The range of percent organic carbon was fairly lower in samples near industrial sites as they are polluted varies between 0.40%-0.46% in comparison to samples of control site (0.87%).The lower organic carbon near industrial sites is due to dry atmosphere and scarce vegetation which act together to negatively influence the soil organic carbon content as compared to control site consisted of relatively high proportion of litter/ plant and animal residue which after decomposition contribute to soil organic matter and organic carbon. Handoo (1983) reported that the organic carbon content varies from 0.45% -4.83 % in Kashmir valley soils with high content in surface soil .The lower organic carbon could be attributed to decline in productivity in the cement polluted sites . This may also be attributed to the fact that cement dust tends to make soils more sandy that usually

retain low organic carbon as compared to soils high in silt and clay .Salem et al (1990) and Zayed et al (2001) reported a decrease in organic carbon content in soils under cement dust influence. Exchangeable calcium and magnesium are secondary nutrients which are required in relatively smaller but in applicable quantities (Tukura et al 2013). Calcium an essential portion of plant cell wall structure provides for normal transport and maintenance of other elements as well as gift in plants. It is also thought to neutralize the effects of alkali salts and organic acids within a plant. Calcium deficiencies are rare when the soil PH is adequate (Snober et al 2011). It also helps in activate many plant enzymes needed for growth. Source of magnesium for plants are soil minerals, organic material, fertilizers and dolomite limestone. Afonrd and Simard (1999) reported that cement dust is a potent source of calcium and magnesium. The sites near the industrial area (site 01 and site 02) show a maximum value 8.03 at site 01 and minimum value of 7.12 at site 02 during study period. The soil samples collected throughout the study period show higher exchangeable calcium level at sites 01 and sites 02 comparison to control site. The higher values of exchangeable calcium in soils around the cement factory might be due to the deposition of cement dust enriched with calcium compounds. The soil samples exhibited higher levels of exchangeable magnesium content in the sites from industry as compared to soil collected from control site. The value revealed an eventful decreasing trend with 4.7 at site 01, 4.2 at site 02 and 1.7 at site 03 (control site). Thus contaminated sites contained higher levels of exchangeable magnesium being constantly received from the emission of cement factory

Phosphorus is made available to plants through the weathering of rocks and decay of organic matter. Phosphorus is essential in cell division and energy transformation and also metabolic processes in plants (Ria et al 2012). Soil phosphorus is available in very low amounts to plants since most of the total soil phosphorus is tied up in insoluble compounds and its availability depends on soil pH (Snober et al 2011). Deficiency of phosphorus in soil may cause plant leaves to develop purple coloration, stunted plant growth and decay in plant development while excess of it may cause micronutrients deficiency especially zinc and iron(Bonnet 1993). During the present study, the total phosphorus fraction was found to be more in control site (3) as compared to site (1) and site (2). This may be due to highly alkaline nature of

the soil due to deposition of calcium enriched dust emitting from the cement factory.

V. CONCLUSION

Kashmir valley witnessed accelerated growth of cement factories during the last few decades due to exploration of large deposits of calcium carbonate. Cement is currently the most widely used material throughout the world. Its production is being recognized to be playing a hazardous role in the imbalances of the environment and producing air pollutants. The cement kilns emit enormous amounts of cement dust into the atmosphere which settle on the soil and vegetation of landscape. The present investigation entitled studies of the impact of cement dust pollution on chemical properties of soil. The same soil on the other hand exhibits a decrease in other parameters like organic carbon. A remarkable decrease in the total phosphorus, magnesium. Calcium and during the present study we have also seen the effect of cement dust on calcium and magnesium which increases near the industrial site.

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