

Physico-Chemical and Elemental analysis of different soil sample found in Northern region of Indian.

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Abstract

Heavy metal contamination of soil is a humourless cause of concern because heavy metals get accumulated in plants, thus affecting humans and animals. In northern India heavy metal adulteration of soil can pose major health risks. Therefore, a spatial study was conducted by collecting different soil samples to analyse the variation in contents of two heavy metals viz. Lead (Pb), selenium (se) in different soil samples. For various parameters analysis and substantial metals investigation of soil from two different areas of roadside and agriculture, soil samples have been collected from these areas from Himachal Pradesh and Punjab. Soil samples were analysed by physio – chemical analysis of Pb and Se. Study of these samples reveals the presence of less or high percentage of these metals in soil that it's lead to error in soil quality. Analysed the pH of soil samples of various places from pH analysis soil mostly found in acidic medium. Such a soil has a very bad effect on ecosystem and human health.

Keywords: *Physico - chemical analysis, pH, Lead (Pb) and Selenium (Se)*

INTRODUCTION

Soil and its composition

The word "Soil" is derived from Latin word "solum", which implies natural material in which the development of plants happens. It is a complex physio-organic framework containing water, mineral salts, and supplements and broke up oxygen.[1]

Soil is fundamentally a non-renewable resource and is not only a part of ecosystem, but also occupies an important role in human lives. Soil has highly complex capacity as filter, buffer, providing anchorage to plants, storage and complete change system, protecting the global ecosystem against the effects of pollution. It is the not right covering on the earth surface with living organism and their result to decay. Soil is made out of particles of demolished shake that have been changed by substance and natural procedures including enduring and disintegration.[2] It is a blend of mineral and natural constituents that are in strong, vaporous and watery states. Soil pieces pack freely, shaping a dirt structure loaded up with pore spaces. These pores contain sol arrangement (fluid) and air (gas).It is an intricate collection of organic and inorganic material both living and dead, water and gases in changing proportions. Important constituents of soil are: minerals (40%), organic matter (10%), water (25%) and air (25%). Inorganic mineral matter is the principal constituents of soil.

The components that go into being in soils in the most noteworthy amounts are Si, Al, Fe, Ca, K, Mg, Cu, Pd [3]. These are likewise significant components found in the World's outside layer and in residue. Oxygen is the most across the board component in the World's outside and in soils. It comprises of about 47% of the World's covering by weight and over 90% by volume.

Soil pollution

Soil contamination is characterized as the publicize in soils of decided dangerous mixes, synthetic compounds, salts, radioactive materials, or sickness causing operators, which affect plant advancement and creature wellbeing.[4] Soil contamination unmistakable from water contamination, in light of the fact that the toxins stay in direct contact with the dirt for longer periods and henceforth modify the substance and organic properties of the dirt. The hazardous substance can likewise enter the human natural way of life from soil or water plants.

Various forms of Soil Pollution

There are two kinds of soil contamination. One is the characteristic procedure – the corruption of soil more than a large number of years. Seawater attack in beach front locale, fermentation of soil, siltation and soil disintegration are the common procedure of corruption of soil. The second is the man-made contamination. Deforestation is the greater factor of man-made contamination of soil. Sewage additionally dirtied the dirt. Utilization of inorganic fertilizer and pesticides can dirty the dirt [5,6]. Quarry and exchange of sand can likewise contaminate the dirt. Diverse noticeable component that lead to the dirtying of soil are recorded as:

1. The major source of metallic adulteration of soil includes mining, smelting, pesticides, fertilizers etc. Metal such as Cd, Pb, Se, Hg, Ni, Cu, Cr etc.
2. Human and creature excreta, ranch squanders, soil conditioners, soil fumigants, radioactive squanders, and so forth. Likewise specialist soil contamination.
3. Domestic and commercial urban wastes consisting of dried sewage sludge as well as garbage and garbage materials such as plastic metal, street sweeping, glasses, waste paper, fibres, rubber etc donate the soil pollution.
4. At that point there are results like plastic and undesirable strong squanders. Plastics are non-biodegradable articles that don't separate and carry with the dirt. Plastic keep from happening an appropriate air circulation of soil[7]. This slaughters helpful microscopic organisms and the dirt around that area winds up futile. Some of them are malignant growth causing synthetic compounds, which influence the dirt.
5. Mining activities also are a big means to pollute the soil. Before mining activities begin, the topsoil is removed. This topsoil which is a very important layer of the earth is not preserved in one place but dumped all over. Thus the soil nutrients are high.

6. Road mishaps also dirty the dirt. There are two kinds of mishaps. The first is when petroleum or diesel run vehicles are associated with mishap. The petroleum or diesel falls on the dirt and misfortune it. Indeed, even the hole of the tank can damage the dirt. The second class is tankers conveying synthetic substances or inflammable fluid. In the event of mishap, the concoction can consume the dirt, they are profoundly thought. When the dirt is consumed it is futile for any reasons.
7. Pesticides are bring into being generally in three structures: Bug sprays, Herbicides, and fungicides. Bug sprays are utilized to obliterate the undesirable creepy crawlies, flies and different animals. Herbicides annihilate the greater weeds; Fungicides can decimate the huge weeds. Plants assimilate just 5% of the pesticides and showers. The rest is ingesting by the dirt. The poisonous substance of pesticides remains in soil for a considerable length of time since they are not biodegradable. They can impact person too.

Adverse impacts of overwhelming metals present in soil

Quite possibly polluted soil or residue ingested either straightforwardly or in a roundabout way because of hand to mouth action which may speak to a critical channel of ecological lethal metals to humans. Kids can without much of a stretch ingest soils or indoor residue unexpectedly when they put defiled toys in their mouth, get nourishments with grimy hands and so on, along these lines making them threat to poisonous metals harming[8]. What's more, grown-up may likewise be presented to comparable risk since consolidation of residue is the most well-known channel for harmful metals to enter in our body.

Gathering of heavy metals may block biochemical process in soils and assist the progress of the entry of toxic metals into food chains. Physicochemical properties of soil can likewise influence the grouping of overwhelming metals in soils. Natural issue and pH are the most valuable parameters so as to controlling the accumulating and the accessibility of overwhelming metals in soil condition.

Heavy metals which have been added to the soil are due to the rapid population progress, increase the rate of urbanization and industrial activities. While the use of fossil fuels and automobile tire diffusion on the roads that get transferred to the soil by process like chemical reaction, rain etc Certain territory are the fundamental wellspring of soil follow metallic pressure managing the incredible arrival of lead and cadmium just as the other follow components, for example, zinc and copper. The rise up concentration of lead and cadmium has caused over standard level toxic to the soil so that environment converting the human hazards like inhalation or ingestion in a long food chain channel. Metals like Pb, Cr, As, Hg, metalloids of As and Se etc. Are discussed to be biologically significant due to their toxic properties at relatively very concentration.[9]

Heavy metal can first place to error in human wellbeing and the earth because of their regular advancement as a contaminant, and the categorization of overwhelming metals as cancer-causing and mutagenic. Soil defilement with harmful metals is especially testing. In contrast to natural mixes, metals cannot be debased, and the cleanup as a rule requires physical or substance evacuation stream [10]. The accumulating of substantial metals in soils of expanding because of the sanitation issues and potential well being dangers just as its hindering consequences for soil environment. These metals have curious qualities including:

1. They don't crumble with time
2. They may be useful to plants at certain levels, but they can not be toxic if they exceed specific thresholds
3. Micronutrients such as iron(fe), zinc (zn) manganese (Mn) are well known to be essential metals for plant growth and yield. However, plants can accumulate heavy metals in soil such as cadmium (cd), nickel (ni), chromium (cr) and lead (pb). Which are not essential for plant growth but can lead to environmental error.

The adverse effect of heavy metal toxicity in biological systems may

Following reasons:

- a) Interaction with DNA leading to mutation
- b) Effect on cell membranes
- c) Effect on regulatory enzymes

These adverse effects in mammals may in the following disorders:

- a) Pathological changes
- b) Symptoms of chronic disease
- c) Formation of tumours
- d) Retardation of growth

Soil, frequently called the Skin of the Earth, is a blend of rotting natural issues (humus), minerals, fluids, and numerous innumerable living creatures. Soil covering the Earth is a medium for plant development and methods for water stockpiling.[11] A specific soil's surface, mineral piece, fruitfulness, and consistency can differ from area to area. Soil is a critical piece of the World's organic network. The world's biological systems are affected in expansive courses by the methods did in the dirt, Ozone exhaustion and a worldwide temperature alteration In the rainforest devastation And contamination of the water. As for the carbon cycle on Earth, soil is a vital carbon repository, and it is possibly a standout amongst the most receptive to human disturbance and atmosphere Change.[12] As the planet

warms, a positive criticism (amplification) has been anticipated that darts will add carbon dioxide to the environment due to expanded natural movement at higher temperatures. This forecast may have been addressed in the light of later soil carbon turnover information.[13]

MATERIALS AND METHODS

Sampling and preparation

Soil sampling was done in the month of March 2018. Ten sites were selected for collecting composite soil samples throughout the Amritsar district, Kangra, Hamirpur, Bilaspur, Ludhiana. The soil samples were air dried, and stored in clean polythene bags until further analysis.

Determination of preliminary Parameters:

LT-50 model, pH meter was used for analysis of soil sample.

For pH analysis, 5 gm of soil sample was taken in beaker and added 50 ml of distilled water. Shake well and filtered solution with the Whatman Filter paper No.42 and then noted the pH of soil sample by the pH meter.

Determination of Elemental Analysis of soil by X-Ray Fluorescent(SHIMADZU EDX-7000)

The spectrometer irradiates X-ray onto the sample and detects fluorescent X-Ray that generated from the sample. This equipment is connected to a computer that has user friendly PCEDX-Navi software.

It is used to determine the elements and their quantity presents in a sample. It is known as Qualitative- quantitative analysis. Each soil samples have different elemental composition like Si, Al, Fe, K, Ca, Ti, S, Mn, Zr, Cu, Sr, Zn, Rb, Cr, Y, Ir, Pb, and Th.

Determination of Pb and Se by Atomic Absorption Spectrometer (Perkin Elme)

The Pb and Se contents were analyzed by Atomic Absorption Spectrometer in air- acetylene flame (ratio 2:4) at wavelengths 283nm respectively.

Before analysis, soil samples were digested to reduce organic matter interference and allow the metal to be converted into a form that the Atomic Absorption Spectrophotometer (AAS) can analyze..

All the samples before analysis were digested in the aqua regia (HCL:HNO₃) in a ratio of 4:1, first one gram of each soil sample was taken in a dry beaker and added 20ml of aqua regia (16ml of HCL and 4ml of HNO₃) in it and then heated the content up to dryness on a hot plate at 100°C. After drying the sample added 60ml distilled water in the beaker. Filtered and collected in bottles. The digested soil samples were analyzed by atomic absorption spectrometer (AAS) for heavy metals.

Result

pH Analysis

In this roadside area pH has been observed in the range of 5.67-6.50. In case of near jalandhar- phagwara highway, Phagwara railway station, near Ludhiana, near Ipu university and Hardaspur road pH values are 7.70, 8.14, 7.75, 6.50 and 5.67 respectively which are within permissible limit. In case of near Hardaspur road soil pH is slightly acidic. Soil samples which is collected from Himachal in different areas like forest range of Hamirpur, Mridulchawk, Hamirpur, Near Gandhi gate, Hamirpur and Godard gate soil pH is 7.24, 7.61, 7.65 and 6.70. In case of near Godard gate soil pH is found in acidic medium.

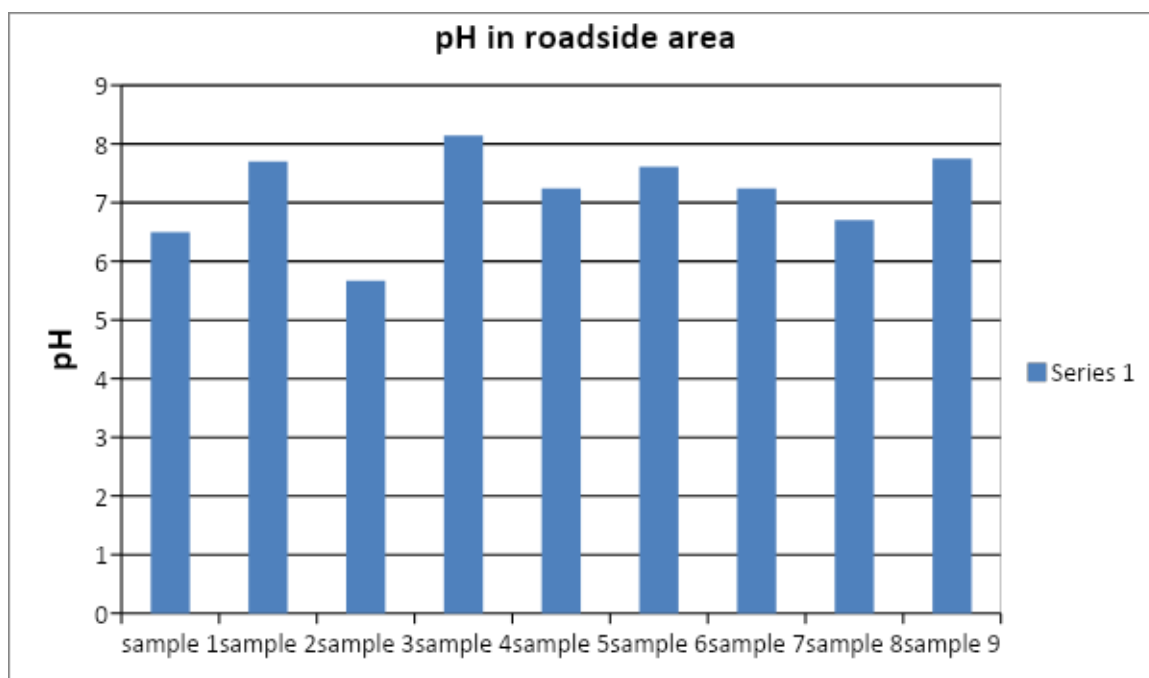


Fig 1:pH Analysis from Road Side area

Elemental Analysis of Soil Samples

Chemical composition of soil which belongs to Amritsar region is Si (61.08%), Al(14.20%), Fe(10.29%), Pb(0.012%), Cu(0.045%). Chemical composition of soil in Ludhiana is Si(53.46%), Al(17.038%), Fe(12.50%), Cu(0.045%), Pb(0.012%). Chemical composition of soil in Hamirpur region is Si(62.86%), Al(13.34%), Fe(10.31%), Cu(0.040%), Pb(0.009%). Chemical composition of soil in kangra region is Si(59.04%), Al(16.79%), Fe(10.68%), Cu(0.042%), Pb(0.010%).

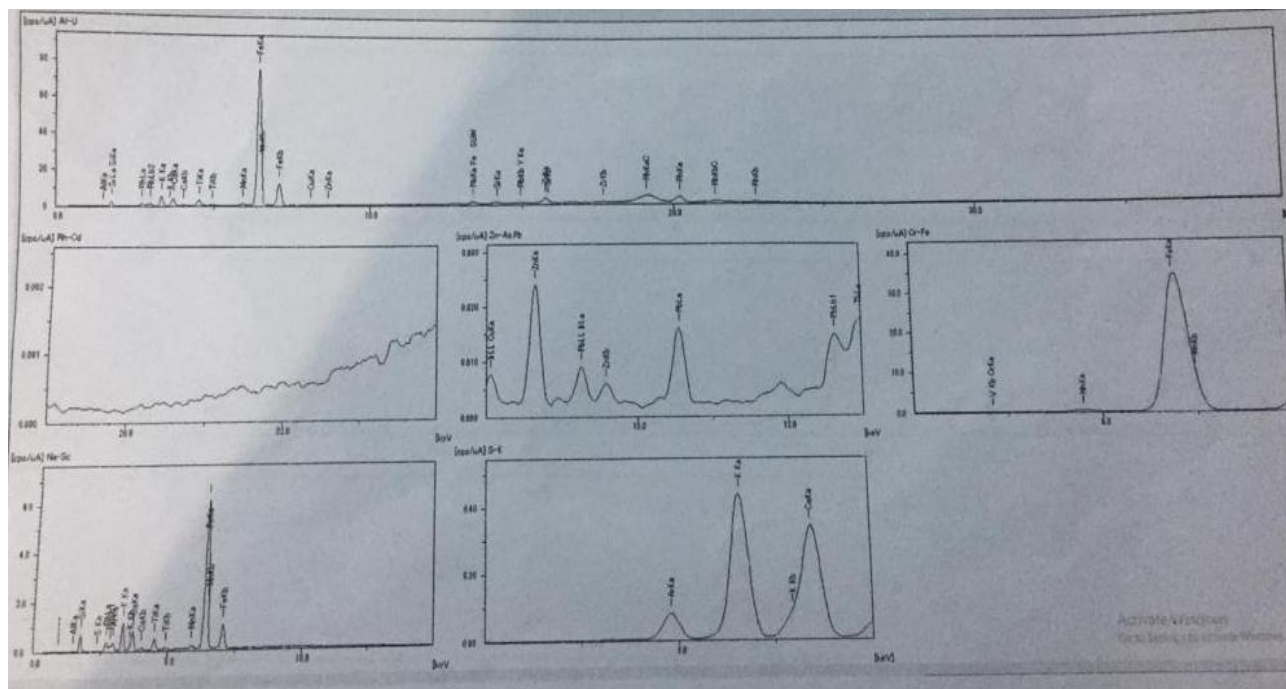


Fig 2:Elemental Analysis of Soil from Himachal Pradesh, India

In this graph the concentration of different elements has been given. First graph represents the concentration of Aluminium (Al) in soil. Second graph represents about the concentration of Rh-Cd in various forms. Third graph represents the concentration of Zn – As and Pb. Fourth graph represents the concentration of the Cr – Fe. Fifth graph represents the concentration of Na – Sc.

The samples were analysed for the heavy metal analysis by Atomic Absorption Spectrophotometer. In which the agriculture field mostly gave quantity of Pb and Selenium which was 3.37 ($\mu\text{g/g}$) and 1.3 ($\mu\text{g/g}$).

Discussion

We can conclude that the pH content in the roadside area and agriculture area have been identified in permissible limit. While we can say that the pH of agriculture area and roadside area have been found below 7 that means in these areas soil acidic in nature. In case of heavy metals, Pb and Se contents in areas of Punjab, have been found permissible limit. Finally on the basis of the above result we can conclude that in Amritsar different region and Himachal Pradesh is not affected by the soil pollution. The soil is not contaminated.

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