Analysis of Soil Samples of Some Districts of Haryana and Punjab, India

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Abstract-The analysis of physiochemical parameters of soil samples from different districts of Haryana and Punjab was carried out emphasizing on selenium levels. These parameters like concentration of selenium, electrical conductivity, sodium and potassium ions and pH of the soil samples were determined. The observed results were analyzed with the help of arithmetic mean, standard deviation and mean deviation. The observed concentration of selenium shows a marked variation in the samples from various districts of Haryana and Punjab.
Keywords: Soil samples, various parameters, Haryana and Punjab.

I. INTRODUCTION

Selenium is a naturally occurring element found in rocks, soil and water. Its original source was probably volcanic activity. Selenium enters the soil profile through the weathering of selenium-rich rocks. Selenium particles move through the soil until absorbed on clay particles, iron hydroxides or organic particles. Through water erosion and sedimentation processes, these particles are distributed and get deposited into upper layer of the soil. Fungi and bacteria play their part in the oxidation process. Sarathchandra and Watkinson[1-2]isolated a soil sample in which they reported that a strain of bacteria showed an important step in the biological cycle or selenium weathered rocks under alkaline and oxidizing conditions, thus selenites and selenates, are formed. These products are highly toxic in nature, as well as highly soluble in alkaline soils, thus facilitating uptake of selenium by certain plants. Selenium is particularly concentrated in soils of the drier regions of the world. This concentrated form is also highly toxic and easily leached from the soil and available to plants. Selenium is currently the trace element of great concern in soils and has come to the public attention very late. Developed countries have paid serious attention towards it, but very less awareness has been paid in India towards determining selenium levels in soil.

In the appropriate concentrations, many metals are essential to life and have important function in biological processes. In excess, the same metal can be poisonous. The concentration of the selenium in most normal soils is estimated to be 0.2 ppm by C.S.Slater and H.G.Byers[3-4]. Acute toxicity of selenium in most animals occurs when the vegetation uptake contains 1000 ppm of selenium.Chronic diseases can occur when the vegetation eaten contains from 5-40 ppm over a sustained period of time. Franke[5] was the first to show that it was the range of plants growing on seleniferous soils rather than the alkali salts or water that was the culprit causing 'alkali disease' among livestock. Olson[6] has investigated chromic toxicity in cattle and found that chronic selenosis or 'alkali disease' could be produced by prolonged feeding of inorganic selenium, however, his result could not be duplicated suggesting widespread susceptibility among cattle and other factors in the biological cycle of selenium uptake and absorption, which should be further investigated. The total concentration of selenium in soils does not directly determine the concentration of selenium in the plants growing on those soils[7]. The chemical bonding and chemical reaction patterns are the critical determining factors since different chemical forms vary in their solubility and subsequent availability to plants. Van-Dorst and Peterson[8] showed that the chemical forms of selenium present in soils and sediments are closely related to the oxidation-reduction potential and pH of the soil. Soil conditions need to be adequate to meet the nutritional requirements of the animals and humans who consume the vegetation with optimum levels otherwise it could lead to chronic overdose. Studies in Denmark and Finland[9] showed that most of the selenium that was added to soil as selenite was rapidly changed to a form that was poorly available to plants. However, selenium added as selenate form stayed in an available form to plants for several months. Hence to

investigate optimum selenium concentration in soil in India becomes important and in order to perform this study, the soil from some regions of Haryana and Punjab was sampled.

II. EXPERIMENTAL

2.1 Stock Solutions Preparation

Selenium: Standard solution of the selenium was prepared with a concentration of 1000µg/liter. 1g of selenium metal was dissolved in the minimum volume of concentrated nitric acid and evaporated to dryness.Then, 2ml of water was added and again evaporated to dryness and repeated it twice. The residue got dissolved in 10%v/v hydrochloric acid and diluted to one liter with 10% hydrochloric acid. Subsequent dilutions of the standard solution were made for the calibration of the instruments.

2.2 Wavelength selection for selenium:

For selenium:Microprocessor basedChemito model 1020 flame photometer was used. The absorption wavelengths which could be chosen for selenium analysis were 196, 204, 206.3 and 207.5 nm with their sensitivities 0.5, 1.5, 6.0 and 20.0 ppm respectively. Total analytical range in which selenium could be determined using these wavelengths was 2.0 to 50.0 ppm.

2.3 Soil samples from Haryana and Punjab

Soil samples were collected from each district of both states. Samples were dried at room temperature. Following parameters of the soil samples were determined before analyzing the selenium contents.

2.4 Hydrogen ion concentration

After rinsing the electrode with distilled water, the instrument was calibrated with buffer solution of pH 4.0, 7.0 and 9.2. The pH of all samples was measured by using 1:2 (w/v) soil and water ratio. The mixture was dissolved to get saturated solution and the samples were stirred well during measurement to provide homogeneity.

2.5 Electrical conductivity

Electrical conductivity was measured by taking 5 g soil in 10 ml of distilled water to prepare a suspension (1:2 w/v). The conductivity meter was calibrated with 0.1 N KCIsolutions before measuring electrical conductivity. The conductivity was measured in micro mho (µmho).

2.6 Sodium and Potassium Determination

Microprocessor based Chemito model 1020 flame photometer was used again, which was sensitive for sodium and potassium in 1ppm range as explained in selenium determination.

III. RESULTS AND DISCUSSION:

Soil samples collected from different districts of Haryana and Punjab were analyzed and the data is observed. It was found that 406.3 ppb selenium was found in Haryana and 263.7 ppb selenium was found in Punjab soil samples on an average. Among the districts of Haryana state, Rohtak district has the minimum level of selenium with a value of 206.8 ppb. Jind district has the maximum level of selenium with a value of 552.06 ppb. District Sonepat with selenium levels 239.0 ppb is another area which is generally affected by floods from time to time because of nearby river, Yamuna. Top soils of many villages nearby Yamuna river are washed away during rainy season every year, whereas district Gurgaon (selenium level 428.33 ppb), district Mahendergarh (selenium level 537.46 ppb), district Rewari (selenium Levels 545.0 ppb) and Narnaul area (selenium level 469.2 ppb), clearly shows that the selenium levels are higher in comparison to the other districts due to dry soils and draughts and also less availability of the irrigation water. This indicates less flow of the selenium towards depth due to non-availability of the water for irrigation. The soil samples of some districts of Punjab regarding selenium show almost normal level in the lower regions. Selenium levels determined for district Amritsar is maximum (288.93 ppb) and Mansa districts has minimum. The average concentration of selenium in USA soils is found as 370 ppb, 880 ppb, 180 ppb, 90 ppb in various states of U.S.A. like US Montana, Nevada andNew York [10-11], US South Texas and US Wyoming[12] respectively,while in Finland[13-14], mean concentration of selenium in some soils has almost normal concentration of selenium. In Canada, concentration of selenium in soil is 230 ppb, 960 ppb, 370 ppb in Eastern Canada, Toronto and Canada Ontario.

IV. CONCLUSION

Hence, we conclude that selenium levels above normal where the soils are drier due to less water availability for irrigation or lesser rains are received. On the other hand, their soils show tendency to be alkaline as it is evident from determining the pH of the soils. However, the soils of Punjab and Himachal Pradesh area show normal levels, where plenty of water for irrigation is available. Floods are also important factor for decreasing selenium level in the soil.

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