

Examining the soil of the Yamuna for various contaminants and its fitness for agriculture and remediation possibilities

Introduction

The rapid industrialization and intensive agricultural activities over the last few decades have resulted in accumulation of various pollutants in the environment, which are distributed over wide areas by means of air and water. Today, many soils throughout the world have undesirably high concentrations of heavy metals. These include lead (Pb), cadmium (Cd), zinc (Zn), mercury (Hg), arsenic (As), silver (Ag), chromium (Cr), copper (Cu), iron (Fe), and the platinum group elements.

Yamuna river is one of the most important rivers of India and is highly polluted. The river water and the adjacent soil are contaminated with various pollutants including heavy metals.

Scope of Work

In this study, effects of seasonal variations and heavy metals contamination in Yamuna river water is observed on physicochemical properties and enzyme activities of soil. Heavy metal content of soil as well as river water was also analyzed to observe their contamination level. Therefore, this study helps us in better understanding the complex relationship between microbes and its surrounding environment.

Materials and methods

Soil sampling and sampling sites

To analyze the impact of seasonal variation and heavy metal concentration on soil enzyme activity, sampling can be done from ten different points along the river course in three different seasons (summer, rainy and winter).

Soil sampling can be done randomly from 1 to 15 cm depth using the rectangular sampler (5 × 5 × 10). At each sampling site, two soil samples were collected, one from river bank and another from nearby fields which are some 100 m away from the river.

In order to determine the water pollution status, water sample can also be collected from the above-mentioned sampling points. These collected soil samples would be stored at 4 °C until further analyzed.

Physicochemical properties of soil and water

1. Moisture Content

Soil moisture content and soil respiration would be determined using R. Ohlinger method

2. Soil pH

Soil pH is measured by using two different buffers having pH 4.0 and pH 7.0 using Corning pH meter.

3. Metal Content

Metal content is determined using AAS by EPA's acid digestion procedure

4. Total organic carbon

Total organic carbon of all the soil samples is determined using modified Walkley-Black method

Enzyme activity assays

Enzyme activity assays would be performed using the freshly sampled sieved (< 2 mm) soils. The activity of four soil enzymes viz. dehydrogenase, urease, arginine deaminase and nitrate reductase

Statistical analysis

Level of significance due to seasonal variations and waste water contamination in all the above-studied parameters can be assessed using two-way analysis of variance (ANOVA) followed by the Tukey's test ($p < 0.001$, Sigma plot version 12.5) except heavy metal concentration. The statistical significant difference in the heavy metal concentrations can be analyzed by three-way ANOVA followed by the Tukey's test ($p < 0.001$, SigmaPlot version).