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Impact of the industrialization on soil surrounding Sirgitti industrial area in Bilaspur

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Abstract

A case study evaluated the impact of cold drink and plastic industries on the soil. Cold drinks industrial wastes are associated with the nutrients, undesirable substance and heavy metals to the soil. High concentrations of these parameters are risky to public health especially when the water flow from these sources is consumed by people for different purpose without any treatment. It has taken extensively study of soil sample in Narmada drinks private limited Sirgitti in Bilaspur district. Many wastes for example rice mill waste, leather industrial waste, plastic waste agrochemical waste and paper industrial waste etc. are discarded as useless in soil which indicate soil pollution. Soil samples were collected from two sampling station in Jan 2022 post-monsoon had been investigated for physicochemical parameters and heavy metals like Zn, Mn, Fe, Na and Mg by standard method as per IS guidelines.

Keywords: Industrial effluent, physicochemical parameters, heavy metal, agricultural impact.

Research Article

1. INTRODUCTION

Scientist experience significant difficulty in selecting a non-polluting accurate economical and simple approach for the separation of heavy metal in sample. Many techniques have been used to separate and determine physicochemical parameter and heavy metals [2-5]. The environment means surrounding in which living being live. The environment is a large basin engrossing everything that is given to it and returns the same in a different form which can be useful or harmful. The harmful is generally known as environment pollutants. These pollutants are widely present in air, water and soil in specific forms. This can be further classified in physical, chemical and biological substance when released into the environment [7]. They impair the normal stable functions of living organism. Environment constituents found their as indicated by the WHO (World health organisation).

The sustainability of any system has become a concern now days. Soil fertility is perhaps the most basic decision-making tool in order to impose appropriate nutrient management strategies. There are various techniques for soil fertility evaluation and among them soil testing to assess the current fertility status as well as provide information regarding nutrient availability in soil [9]. Water pollutants are transported into the soil medium through surface runoff during rainy season and penetrate to soil system. It can dissolve in soil and effect soil characteristics. Physicochemical soil parameters such as pH, electrical conductivity, [10] colour, soil texture, alkalinity, hardness, DO, BOD, COD and heavy metals contaminated which can be measured [11-15]. A case study related to the soil fertility status of industrial area Sirgitti in Bilaspur is structured. Therefore, it is important to investigate the soil status and soil parameters. It is in line to provide valuable information relating crop research. [16-18]

Study Area

Fig 1 Sampling Station

Bilaspur city is the 2nd largest city of Chhattisgarh State. It is located between the $21^0$47'-$23^0$08' north longitudes and $81^0$41' to $83^0$15' east latitudes. There are various types of industries for production and famous for its unique characteristics like rice quality, kosa and mineral from one mine are located in Hirri village. One public sector industry, the NTPC Sipat generates powers. The Arpa river cross Bilaspur city. Thus, in this circumstance there are various scope for the research which is especially focused on basic nature of soil and there duality also. It is also important city for the Indian railways. Bilaspur city is surrounded by many large and small industries. Due to this huge industrialization soil, air and water are affected by pollutants. Therefore, it is essential to explore the quantity of pollutants present in the earth. The Chhattisgarh High court located at Bodri. Bilaspur district has privileged it with the title "Nyaydhani" (Law capital) of the state. This city is also the commercial centre and business hub of north east Chhattisgarh region.

2. MATERIALS AND METHODS

Soil Sampling The surface soil sampling (0-20cm depth) was collected from Narmada drinks Pvt limited Sirgitti Bilaspur during January 2022. Altogether soil sample were collected from another industry in Sirgitti area.

2.1 Laboratory Analysis

The collected soil samples were analysed for different soil parameters according to standard method adopted for analysis [19-25].

Fig 2 Soil Sample of both station

In situ measurements-temperature, pH, EC etc. were measured via water analyser kit and DO by Winkler's method, BOD by measuring DO difference after incubation and COD by closed refluxed digestion [26-29]. The major cations such as sodium, potassium, calcium and magnesium were measured by flame photometer [29-31]. Anions such as fluoride, chloride, sulphate, phosphate and nitrate are measured by spectrophotometer. Heavy metals measured by atomic absorption spectroscopy (AAS) [32-34].

3. RESULTS AND DISCUSSION

The sites considered are exposed to soil pollution from the above-mentioned industries. Values for various physicochemical parameters after exposed to soil pollution from collected soil sample from studied area Sirgitti is shown in Table 1.

Table 1 Value of parameters in S1 and S2

Soil parameters	S1	S2	Indian Standard value
pH	**8.8**	**8.5**	6.5-8.0
EC	1340	1484	750-2000
Alkalinity	435	468	200-600
Hardness	**396**	**492**	60-100
DO	4.2	5.4	5
BOD	**5.82**	**6.23**	5
COD	**31.22**	**36.5**	10
Calcium	**251**	**260**	200
Magnesium	**32.8**	**36.4**	30
Sodium	**272**	**280**	200
Potassium	**28.0**	**30.0**	10
Fluoride	1.08	1.20	0.13-1.31
Chloride	537.42	**644.28**	200-600
Sulphate	**581**	**640**	200-400
Phosphate	0.06	0.14	0.1
Nitrate	**51.07**	**52.82**	45-50
Zinc	0.100	1.20	0.4-3.9
Manganese	0.200	0.250	0.1-0.3

where,

S1 = Sampling station -1 (Narmada drinks Pvt. Ltd.)

S2 = Sampling station -2 (Shree Sai plastic Industry).

The case study is to access and monitor importance of environmental pollution caused by plastics and their high risks for the ecosystem. So many studies have been focused on their distribution. and their adverse effects on living beings as well as residual impacts of the contaminants after treatment. The investigation results indicated much higher values for some sample than their standard discharged values. These higher concentrations are highlighted in bold font (Table 1) which cause adverse effect on living beings. Parameters pH, hardness, BOD, COD, calcium, magnesium, sodium, potassium, sulphate and nitrate show higher concentration than standard values recommended for soil. Industrial effluents need a continuous monitoring and management. All parameters namely Alkalinity, Hardness, Dissolved Oxygen (DO), Biochemical Oxygen demand (BOD), Chemical oxygen demand (COD), Calcium, Magnesium, Sodium Potassium, Fluoride, Chloride, sulphate, phosphate, Nitrate, zinc and manganese are in mg/l or ppm except Electrical conductivity (EC) (µ mhos / cm).

3.1 Characteristics of study area

Investigation of samples through physicochemical analysis provided immediate characteristics of the sampling sites. The pH of the samples was in the range of 8.5 to 8.8. pH range of soil is recommended to 6.5 to 8.0 otherwise soil significantly affects plant growth, plants nutrients availability by controlling the chemical forms of nutrients and influencing chemical reaction. The EC were in the range of 1340 to 1484µs/cm. It is reported that higher concentration of EC causes of salinity management and produce problem related to EC and relationship of soil function, Total Alkalinity were in the range of 435 to 468 ppm and causes of poor soil structure and low infiltration capacity, Total hardness were in

the range of 396 to 492 ppm it is resulted from soil corrosion. Chloride was found in range of 537.42 to 644.28 ppm higher concentration of chloride can causes of toxicity problems in crops and reduce the yield. Fluoride was in the range of 1.08 to 1.20 ppm, higher concentration of fluoride cause of reduction of metabolism activity of soil, Sulphate were in the range of 581 to 640 ppm, DO were in the range of 4.2 to 5.4 ppm. BOD was in the range of 5.82 to 6.23 ppm. COD was in the range of 31.22 to 36.5 ppm. Higher concentrations of DO, BOD and COD can be cause of respiration disease and soil pollution. Nitrate was observed in the range of 51.07 to 52.82 ppm. Phosphate was found in the range of 0.06 to 0.14 ppm, Sodium were in the range of 272 to 280 ppm, Potassium was detected in the range of 28.0 to 30.0 ppm. Calcium was in the range of 251 to 260 ppm, Magnesium was in the range of 32.8 to 36.4ppm, Manganese was in the range of 0.200 to 0.250 ppm, Zinc was in the range of 0.10 to 1.20 ppm. In soil, presence of heavy metal causes of reduction of heights and biomass of plant. Accumulation of Zn in soil cause reduction of crop productivity and nutrients along with damage to soil texture. These points indicate that's such type of soil unfit for auricular field. These high concentration of soil parameters indicate to much soil pollution present in the sampling station which is unsuitable for living organism. All the sampling station showed very poor quality of soil and confirmed pollution from pollutants released from industrial effluent which possess great concern of health.

In Industries, heavy metals release is one of the important soil pollutants that are persistent and toxic in nature. Intake of heavy metals can cause significant detrimental health issues in humans. They can cause of organ damage, carcinogenic effects, oxidative stress, damage nervous system, respiratory failure, reduced growth and development. They are poorly degradable toxic metal and prominently disturb ecological balance. Dyes and plastics are emerging contaminants which have been extensively spread in soil and environments. We are at the beginning of understanding of the risk of these pollutants. Better understanding to the occurrence and new techniques and negative influence of these particles in the environment is needed.

3.2 Bioremediation of Heavy Metals in Soil

Bioremediation is a branch of biotechnology that employs the use of living organisms like microbes and bacteria in the removal of contaminants, pollutants and toxins from soil. Bioremediation relies on stimulating growth of certain microbes that utilize contaminants like solvents and pesticides [38-42]. These microbes convert heavy metals and harmful substance into harmless gases like carbon dioxide. Bioremediation is time taking process and use for reduction of heavy metals in soil. *Terminalia arjuna* and *Albizia Procera* act as more potent bio adsorbent for removal of hazardous soil pollutants from industrial waste of soil.

Terminalia arjuna and *Albizia procera* bio adsorbents are prepared in laboratory with the help of fresh dried wood of respectively plants in muffle furnace at a moderate temperature. And these bio adsorbents feed into sample for treatment of soil sample. Heavy metals are generally removed through immobilization, biosorption followed by bioaccumulation etc. Bioremediation can also occur by sulphate reducing bacteria like *Albizia procera* and *Terminalia arjuna*. *Desulfovibrio desulfuricans* converts sulphate into hydrogen sulphate which reacts with heavy metals such as zinc, iron and manganese to form insoluble metal sulphites [44-49]. Most of the above microbe assisted remediation is carried out by ex-situ. Genetic engineering can also be adopted microbial assisted remediation of heavy metals in polluted soil and make soil favourable for usage.

Conclusions

It is clear that with the above data collected and compared with IS value and WHO data. From the above experimental results, it is concluded that waste from sources which effluents are continue associated with high degree contaminants in all seasons. Plants growing on heavy metal polluted soils shown reduction in growth due to changes in their physiological and biochemical activities. This is especially true when the heavy metal involved does not play any beneficial role to growth of plants. Especially heavy metals and the concentrations of EC, TDS, heavy metal in high amounts harmful for soil and loss its fertility and produced toxic effects. After the assessment Sirgitti industrial area Narmada drinks Pvt ltd and Shree Sai plastic industries are not fit for agricultural while harmful for public health. Industrial effluents need a continuous monitoring and proper management like solid waste management. We have suggested to the peoples that before discharge these industrial wastes require segregation process and treatment of waste is necessary while considering open area for especially potable and agricultural purpose.

Conflict of Interest

The author declares no **Collaboration** of interest.

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