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Effect Of Waste Water On Chemical Properties Of Soil In Sargodha Region

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Abstract

Water that has been contaminated by home, industrial, or commercial use is referred to as wastewater. As a result, the composition of all wastewaters is always changing and highly variable. The use of wastewater for irrigation is becoming more popular as a technical option for reducing soil deterioration and restoring soil nutrient content. The current study investigated the effect of wastewater on the chemical properties of the soil in the Sargodha region, Punjab, Pakistan. A soil survey was conducted at two sites of Sargodha to analyzes the consequence of the use of wastewater on soil chemical attributes. Data recorded showed that soil chemical properties undergo abrupt changes with the application of wastewater. It causes lessening in the pH and enhancement in the EC, TSS, Organic matter, and soil phosphorous. It was concluded that soil wet with sewer water results in actual illness danger for humans begins and with surrounding real danger. Wastewater use also causes hazards for plant growth.

Keywords: Wastewater, EC, TSS, Organic matter, soil phosphorus

Iintroduction

The need for water is enhancing day by day in low rainfall areas (Rebi A, et al.2021). That is why high-quality water is stored for the sake of intake and the water containing waste is stored for other purposes such as irrigation etc. (Khairuzzaman MD, et al.2014). Domestic water is cost-effective and is a good source of irrigation purposes nowadays (Rout PR, et al.2021) Therefore, reusing of wastewater for supplying is quickly increasing in almost nation (Shin C, et al.2021). Moreover, waste water is a precious origin for flora nutritious and organic matter required for keep fertility rate and productiveness of drylands (Hameed MU, et al.2021). Domestic wastewater has primary plant substances like nitrogen, phosphorus, potash, and other nutrients that are beneficial for plants growth (Vikash A. et al.2014). In underdeveloped nations, population growth enhanced the supply of an immense amount of water for housing, municipal, and commercial enterprise purposes. In low rainfall areas, application of wastewater is enhancing along with freshwater resources decreasing day by day that is useable for agriculture (Rebi, A et al.2021). But in some other areas, where less access to water (Jalali, M.et al.2007) Sewer water contains more nutrition value which is effective for plant growth. When soil is provided with wastewater it provides more energy (Duan and Felder, 2009). For irrigating agricultural soils the use of wastewater founded to bring many changes as it improves the N, P, K, C, and Mg concentration within the land rather than good quality water is applied to soil (Rai, S.et al.2011). In the low rainfall areas of the world, sewer water application is considered a very effective treatment. It is environment friendly (Yang, SS. et al.2021). So wastewater application is a very good method that decreases the good quality water pressure mostly in low rainfall areas (khan et al.2021; Heidapour, M. et al.2007). By using wastewater more concentration of salts are accumulated on the soil surfaces which reduce the germination rate and plant growth ultimately yield is affected (Duan and Fedler, 2009).Soil serves as a biofilter which decreases the concentration of waste and increases the soil chemical properties that can reduce a large part of domestic wastewater pollutants, but this filtering increases EC, SAR, Na, Ca, and Mg of soil (Rebi A, et al. 2021). In addition, it has also a high concentration of toxic metals that enhance the heavy metals in the soil. Many metals go to the food chain and cause serious problems in the health of animals and humans (Singh K, et al.2004).The treated wastewater has been founded to increase soil electrical conductivity. With the increase in the EC of the land, it means that cations concentration is an increase in the soil. By application of treated sewer water soil acidity decreased. So by the reduction of acidity increased the level of organic materials Application with treated water, SAR of the soil is increased and replacement of Na with Ca is also increased (Mohsin and Ali, 2017).The utilization of sewer water for the supply proposal has been enhanced because the availability of other water resources become more limited and the disposal of wastewaters into streams has been more restricted. Wastewater not only as supplemental provision water merely also a reference of plant nutritive such as nitrogen, phosphorus; organic matter (Gibbs P, et al. 2006). Thus Soil serves as a natural medium for plant maturation, serves as a natural pool of water and nutrients, and is a medium for the filtration and breakdown of injurious wastes. The objective of this study was: (1) to check the effect of wastewater on the chemical attributes of the soil.

Methodology

The present study was conducted with the celebration with Soil and water testing laboratory, Sargodha, Punjab, Pakistan. A soil survey was conducted for the analysis of pH, EC, organic matter, Phosphorus in soil samples having wastewater application. So the procedure is following

Study Area

The current study was conceded out at three different sites (Chak#79, Chak#50, and Chak#46). Within District Sargodha. The experimental area is located at coordinates 32° 21' 20.52" N, 73° 00' 44.67" E. Site-I.

Collection of samples

In the Sargodha regions, many wastewater channels are diffusing. Generally, these transmissions are beaded but at a few places, they are wide. To find wastewater effect on chemical properties of soil wet with wastefulness water, several farmer's fields were selected. A total of 20 samples were collected from Sargodha (Chak#79, Chak#50, and Chak#46).

Soil sampling

Samples were taken by using auger from (0-15cm) depth. After taking soil, it was passed within the sieve (2-3mm) air-dried and sun-dried. When the grinding of soil has been done, soil samples have been stored and used for analysis.

Physiochemical properties of soil

There was 20(g) of soil was saturated in 20 ml DW(distilled water) and combined fit until liquefied. Going the solution for (16) hrs. In the end, pH was founded byutilizing a pH meter. While pH is 1:1. There were taken (50) g soil in the beaker and added DW drop by drop until saturation paste is formed. This paste was kept for almost (16) hrs. The solution was passed through a centrifuge machine for 5 minutes and finally, EC was measured with the help of an EC meter at (25^{o}C) with (0.01NKCL).

Phosphorus determination

A beaker of 250 ml was taken and 2.5g of soils were added to it. After that was taken sodium bicarbonate of (50ml) was added to the previous solution and mixed well and pH was 8.5. The whole solution was filtered with the help of (filter paper). At the end samples were run on the spectrophotometer and P was determined.

Organic matter determination

Preparation:

Dry **[$K_2Cr_2O_7$]** was taken in an oven at (105)°C for (2) hrs and chilled in desiccators. Dissolved 49.09g potassium dichromate in1Ldistilled water toprepare 1N solution of potassium dichromate Weigh 1g of dry soil in a conical flask of 500ml. then there was added 10ml potassium dichromate $K_2Cr_2O_7$ 1N was. Then added 20 ml H_2SO_4 and leave it for about 30 minutes to cool. After that 200ml DI water + 10ml conc. Orthophosphoric acid was added, let it cool, and also 10-15 drops of biphenyl amine indicator. Put on the stirrer. Titrate against (0.5 M Ferrous sulfate) solution. As color was changed to green from blue. Run blank as well.

Results and discussion

Soil pH

Table: 1 is showing the effect of wastewater application on three different soil sites of Sargodha. Thus there is variation in results obtained. Wastewater application cause changes in soil pH significantly. The results showed a significant reduction in soil pH, in soils irrigated with wastewater. PH is one of the most essential parameters of water, and even minor changes can enable it to lose its suitability for drinking and other uses. The higher pH finding suggests that the tannery waste water was alkaline, above the BIS permitted limit of 5.0 to 9.0. The highest pH values were found in samples 16 and 18 of tannery wastewater, which was 8.1 and 7.8 respectively. The presence of carbonates and bicarbonate in the tannery effluent causes it to be alkaline. Navaraj and Yasmin both reported similar outcomes (2012). There have been also founding similar results in (Vaseghi et al. (2005); Rattan et al. 2005).

Electrical conductivity (dSm^{-1})

Conductivity is a measure of a substance's electrochemical properties as well as an indirect indicator of its salt content. At three different sites, the maximal EC was 17.9 and 14.5 dSm^{-1}, respectively. The presence of chloride ions and inorganic salt cations (Na+, K+, Ca2+, and Fe3+) causes increased conductivity, which increases salinity in water. Murali et al., (2013) found increased conductivity in both untreated and treated tannery effluents, indicating more chemical discharge as cations and anions in waste water. Analysis of data showed a significant addition in EC (electrical conductivity) of soil. Owed to the application of wastewater. An abrupt change in EC is observed. Application of wastewater increased the EC of soil from 3.2 to 5.5. Due to an increase in EC, there is a high risk of affecting plant growth and an increase in soil acidity. These results were similar to the findings of (Rusan et al. 2007; Jahantigh, 2008; Khai et al. 2008).

Soil organic matter (%)

Irrigation with wastewater improved the OM content of soil (Table 1). This is most likely due to the higher OM content of wastewater. Organic matter is a very good constituent of soil fertility because it improves soil's different physical, chemical, and biological properties as it is helpful in the plant nutrients and also a good source of moisture. The best amount of organic matter was found in the soil irrigated with wastewater. Results show that organic matter enhances almost (1.2%) by the application of sewer water. This is in with findings of Debosz et al. (2002) and Khai et al. (2008).

Extractable phosphorus (mg/kg)

Agreeing to Table 1, soil irrigated with wastewater triggered a proliferation of phosphorus. This is because of the higher P content of sewage water. Wastewater application increase soil available P alternatively. As wastewater is a source of P. thus an increase of up to 42 to 48% of P is found in 20 samples of soil. That will be accumulated on the top layer of the soil. Thus these results show that phosphorus increased by the application of waste water. Similar findings with (Muster et al., 2013, Rahman et al., 2014, Doyle and Parsons, 2002).

Table1: Consequence of sewer water on Soil Chemical Attribute

Samples	$pH_{1:1}$	EC (ds m^{-1})	TSS	O.M %	P (mg kg^{-1})
1	7.2	6.01	60.1	1.00	36
2	7.4	7.08	70.8	0.69	35
3	7.3	7.24	72.4	1.14	34
4	7.1	8.2	82	0.86	35
5	7.2	4.9	49	1.03	38
6	7.3	2.59	25.9	0.83	41
7	7.4	3.96	39.6	1.21	45
8	7.1	6.06	60.6	1.72	64
9	7.0	5	50	1.41	59
10	7.2	5.07	50.7	1.31	41
11	7.1	7.9	79	1.28	58
12	7.0	17.9	179	1.38	64
13	7.3	12	120	1.28	55
14	7.1	14.5	14.5	1.21	51
15	7.6	6.05	60.5	1.03	41
16	8.1	4.4	44	0.97	27

17	7.7	4.51	45.1	1.38	56
18	7.8	5.31	53.1	1.55	88
19	7.7	4.5	45	1.41	59
20	7.6	4.15	41.5	1.07	54

Conclusion

Asoil survey was conducted at three sites of Sargodha to analyze the consequence of the use of wastewater on soil chemical attributes. Data recorded showed that soil chemical properties undergo abrupt changes with the application of wastewater. It causes lessening in the pH and enhancesthe EC, TSS, Organic matter, and soil phosphorous. Soil wet with sewer water results in actual illness danger for human begins and with surrounding real danger. Wastewater use also causes hazards for plant growth. P in wastewater has a significant potential for recycling. Up to 50% of yearly applied mineral P fertilizer in agriculture might hypothetically be replaced in Europe if sewage sludge was used effectively (Egle et al., 2014, Schoumans et al., 2014). Human excrements play a limited influence in the anthropogenic P cycle when other key P imports such as feedstuff and food are taken into consideration. There are already a variety of methods for recovering considerable amounts of P from wastewater. P recovery from wastewater does not offer a significant technical difficulty, and various techniques are ready for full-scale application. P can be recovered instantly through deposition or after a step of P enriching using an ion exchanger, for example. Ion exchangers, on the other hand, have issues with the complicated composition of wastewater (low selectivity and unwanted adsorptions). This P removal phase is the final barrier before receiving waters, therefore having a trustworthy technique is critical. In the case of WWTP, the recovery potential is roughly 50–70%, although there is yet no demonstration of a full-scale plant. The sewage in main drains was of higher quality than that in industry outlets, although irrigation was not done safely. The roots of fruits and vegetables gathered more metals than the foliage of the plants. Safe management methods based on scientific study are required.

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