

Physiochemical Evaluation of Woolen Textile Effluent Impacted and Un-impacted Agricultural Soil of Bikaner City, Rajasthan

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ABSTRACT

The industrial and technological development for economic blessings has been enforcing terrible effect on the environment, in terms of its degradation and pollution. To locate the impact of the industrial effluent on agricultural soil this look at turned into carried out on impacted and non-impacted soil of two regions i.e. Jorbeer and Gadhwala respectively of Bikaner district. The soil quality was analyzed by estimation of physicochemical parameters such as pH, electrical conductivity(EC), water holding capacity, texture analysis, organic carbon, organic matter, total hardness, sodium, potassium concentration, sodium adsorption ratio(SAR), Cation exchange capacity(CEC) using standard protocols. The results showed a significant difference between pH, EC, Water holding capacity, total hardness, SAR, CEC of both the soil, inferring the impact of industrial effluent on the quality of soil. Therefore, to guard the deterioration soil high-quality, manipulate on such business pollution assumes extra importance which may be assured by using deliberate industrialization.

Key words: Agricultural soil, Industrial pollution, Woolen Textile industry,

INTRODUCTION

Soil the “skin of earth” is an important useful resource for plant growth and means of storage of water and vitamins. soil surroundings is getting impacted via business effluents worldwide mainly in developing countries as price input is required for treatment of business waste earlier than discharge in natural ecosystems (Ahmad et al., 2012). Pollution of soil and water by the improvement of industrialization has turn out to be a rising trouble in urban-industrialized international locations as properly (Hu et al., 2013). The untreated or improperly handled waste and discharges from these industries are becoming principal reason for environmental damage. This hazard is frequently irreversible and causing high impact on human health and premature mortality posing extreme issues to human race. the industrial effluents incorporate natural, inorganic compounds with different biodegradable materials which gather at dump web sites in soil and water systems (Karthikeyan et al., 2010).heavy metals present in these discharges without difficulty input food chain from contaminated soil used for production of vegetation which has direct result of man and environment(Principi et al., 2006).

Jorbeer is located in east of Bikaner at 23°42'-23°forty nine' N latitude and 72°forty three'-seventy two°50' e longitude (Joshie et al., 2011), it's far famous for textile industries. Those small and big scale industries are very well-known for its block printing, which is executed with vibrant colors. Jorbeer prints are popular at some stage in the sector and the products from these industries are exported in massive amount. These fabric printing industries makes use of diverse kinds of ago dyes like direct, reactive, fast, mordant and premetalised and many others. (Goyal et al., 2014). As a result, the effluent from those industries carries dyes numerous heavy metals in greater than the permissible limit, influencing plantation and

surroundings. These industries dispose their untreated effluent within the open land, river and agriculture fields nearby (Pande et al., 2009) which affect the water and soil by means of leaching or because of percolation of pollutants. 2d sampling website online is Gadhwala which lie 23°82' N range and 73°seventy eight'e longitude (Google maps), this place has agricultural farms with no effect of any industrial effluent. the prevailing study become deliberate to research the physicochemical parameters of impacted and un-impacted soil to discover the deleterious effect of the economic discharges on the soil great which may be concluded by this examine.

MATERIALS AND METHODS

Soil Sample Collection

Soil samples have been gathered from nearby agricultural field receiving fabric effluent in Jorbeer vicinity and an un-impacted agricultural soil of Gadhwala vicinity, Bikaner, Rajasthan. Those samples had been collected inside the month of January 2017 in sterile polypropylene zip lock baggage from a depth of 10-15cm. samples had been surpassed through 2 mm sieve to eliminate sand gravel, plant particles and saved at 4°C. Those samples have been analyzed for their physicochemical parameters. The soils samples have been detailed with lab name i.e. impacted soil of Jorbeer as "S₁" even as un-impacted Gadhwala soil as "S₂".

Physicochemical Analysis

Physiochemical analyses of both the soil sample were done using standard methods. Physical parameters like pH was measured by digital pH meter (Electronic India, digital pH meter model-III) calibrated with pH- 4 and 7 buffer (Maiti., 2003) to estimate the acidity or alkalinity of the soil as it indicates the suitability for crop plantation and availability of nutrients. EC is a measure of soluble salts in the soil which was determined by digital conductivity meter (Century CC- 601).Water holding Capacity of soil depicts the physical and chemical health of soil which was performed using gravimetric method (Maiti, 2003).



[Fig-1 Photograph of Woolen textile Industry taken by self]



[Fig- 1 Image of Woolen textile Industry taken by Google map]

Texture of soil was determined by sieving method (Gee and Bauder., 1986) to find whether the soil is sandy, clay or silt in nature, as it depicts nutrient retention and water storage condition. It was interpreted using soil texture triangle according to USDA (United States Department of Agriculture) guidelines. Chemical Analysis included the estimation of organic carbon and organic matter (Rapid titration method, Walkley and Black, 1934), Total hardness by determining Calcium and magnesium content (EDTA titration method Tucker and Kurtz., 1961), whereas sodium and potassium ions were also determined (Ammonium acetate method by flame photometer, Lal Singh 2012). All the above determined positive charged elements helped establishing the cation exchange capacity (CEC) as it is the capacity of soil to exchange cations. Sodium adsorption ratio (SAR) is the only factor which determines the suitability of water used for irrigation (Moasheri *et al.*, 2012) of agricultural soil was estimated using sodium, calcium and magnesium values. Following formula is used where all the ions in milli equivalents/liter.

$$S.A.R. = \frac{Na^+}{\sqrt{\frac{1}{2}(Ca^{++} + Mg^{++})}}$$

Statistical Analysis

Each parameter was performed in triplicates and results were represented as mean ± standard error. The results of impacted and un-impacted agricultural soil were compared using unpaired student's t-test at the significance levels of $p < 0.05$, $p < 0.001$, $p < 0.01$. The Statistical analysis was performed using Microsoft Excel (Version 2007).

RESULT AND DISCUSSION

In this study adverse impact of textile effluent on agricultural soil was deduced by comparing Impacted and un-impacted agricultural soil results are supported by Statistical interpretation (Table). On analysis of soil pH, both the soils were estimated to be neutral to alkaline, although the pH levels differed significantly ($p < 0.001$). Electrical conductivity and Water

holding capacity of sample S_1 was also found to be significantly higher ($p < 0.001$) than the sample S_2 . Texture of S_1 soil was very fine sandy soil which contains 92.1% sand, 6.8 % silt and 1.1 % clay, whereas soil S_2 was found to be Sandy loam containing 62% sand, 28.4 silt and 9.6% clay particles. Carbon content was nearly same for both the soils showing similarity in their agricultural use. Organic Carbon (%) of S_1 and S_2 was 1.103 ± 0.100 , $0.851 \pm 0.720 \pm 0.004$, while organic matter (%) was 1.813 ± 0.162 and 1.33 ± 0.013 respectively. Total hardness (%) of both the soils varied drastically i.e. 436.3 ± 0.33 (S_1) and 53.01 ± 0.063 (S_2). Calcium Magnesium ratios also varied from 3.0 to 4.1 in un-impacted and impacted soil respectively. Sodium content of the two soil samples were significantly ($p < 0.05$) different from each other. But this was not the case with potassium content which showed similarity in the amount of K in both the soils with S_1 having 0.02 ± 0.001 meq/100g of soil while S_2 nearly with same value of 0.017 ± 0.001 meq/100g of soil. Cation exchange capacity and Sodium adsorption Ratio was deduced from the above cations value which also showed difference ($p < 0.001$) in both the soils.

Table: Results of Physico-chemical Parameters of agricultural Soil S_1 (Impacted Jorbeer soil), S_2 (Unimpacted Gadhwal soil).

S.N.	Physical Parameters	Unit	Jorbeer impacted Soil (S_1) (mean±S.E)	Gadhwal un-impacted soil (S_2) (mean±S.E)
1	pH		$8.113 \pm 0.001^*$	6.613 ± 0.005
2	Electrical Conductivity	(mS/cm)	$0.603 \pm 0.016^*$	0.214 ± 0.003
3	Water Holding Capacity	(%)	$60.342 \pm 0.913^*$	20.07 ± 0.23
4	Texture Analysis		Very Fine Sandy Soil	Sandy Loam
Chemical Parameters				
1	Organic Carbon ^{NS}	(%)	1.103 ± 0.100	0.720 ± 0.004
2	Organic Matter ^{NS}	(%)	1.813 ± 0.162	1.33 ± 0.013
3	Calcium	(ppm)	$336 \pm 0.13^*$	41.17 ± 0.29
4	Magnesium	(ppm)	$84.30 \pm 0.66^*$	13.3 ± 0.03
5	Total hardness	(ppm)	$436.3 \pm 0.33^*$	53.01 ± 0.063
6	Ca ²⁺ /Mg ²⁺		4.1	3.0
7	Sodium	(meq/100g soil)	$0.053 \pm 0.001^{**}$	0.03 ± 0.003
8	Potassium	(meq/100g soil)	$0.02 \pm 0.001^*$	0.017 ± 0.001
9	Sodium Adsorption ratio (meq/l)	(meq/l)	0.141 ± 0.009	0.313 ± 0.012
10	Cation exchange Capacity	(meq/100g soil)	$2.46 \pm 0.003^*$	0.343 ± 0.002

* = $p < 0.001$ (Highly Significant), ** = $p < 0.05$ (Statistically Significant), NS=non significant

Soil characteristic feature depicts the health of soil for agriculture that is of incredible importance for our agricultural financial system. The unfavorable effects of pollutants from untreated fabric effluents on the rural soil has been studied and mentioned on this paper. The agriculture soils have been gathered from impacted place, receiving commercial discharge

drain nearby the field (S_1) and the alternative from un-impacted vicinity without a textile generators close by (S_2) were taken for the examiner.

The most fulfilling pH range required for plants within the soil is from 6.5-8.5, which is considered as neutral range for vegetation (Ramachandra et al., 2012). S_1 impacted soil showed better pH (alkaline) than S_2 showing the accumulation of salts due to the publicity to the effluents which is also stated via Patil et al., 2014. Reddy in 1991 stated the impact of better pH in contaminated soil significantly effecting the seed germination.

The amount of soluble salts within the soil has direct courting with the conductivity as it is the cutting-edge wearing capability of soil (Ramachandra et al., 2012). Electric conductivity of soil determines the salinity of agricultural soil, making it very essential thing. The EC of impacted soil become substantially higher ($p < 0.001$) than un-impacted soil which may be due to ions within the effluent. Similarly, high stage of EC has additionally been pronounced by means of Goyal et al., 2014 on the same website online.

Water conserving capability shows physical circumstance of soil, it's far the factor at which soil receives absolutely saturated with water. this capability become discovered to be notably higher in S_1 than S_2 which supports the reality that pollution and business discharges increases the soil water keeping capability (Sheikh and Irshaad 1980, Rai et al., 2011).

Increase in soil water retention in sandy soil texture, in keeping with Tisdall and Odde 1982 is because of growth in natural depending in effluents. while sandy loam soil of web page S_2 depicts right conditions for the provision of highest culturable micro organism which may be due to excessive pH, excessive Cation change capacities of soil sample which are main elements which elevates the variety of cultureable micro organism (Faryal et al., 2007).

Soil organic carbon (OC) and organic depend (OM) have long been diagnosed as elements which are vital for soil fertility in herbal ecosystems (Kucharik et al., 2001). natural carbon and organic remember become slightly higher in contaminated soil which indicates the prolonged accumulation of carbon in soil. the higher OM results in the increase water content at field capability, available water content in sandy soil and will increase each air and water go with the flow prices via excellent textured soil (Ramulu. 2001). as each the soil samples belong to the rural subject where carbon is fixed by means of plant life and is transferred to the soil through lifeless plant rely including useless roots, leaves and fruiting bodies (lal.,2008) this helps the non full-size variant in carbon content of both soil samples which incorporate almost same organic content material.

The amount of Ca^{2+} , Mg^{2+} , Na^+ , ions in impacted soil had been a good deal higher as the soil changed into infected from commercial effluents that have additionally been said earlier by using Devrajan et al., 1996, Baskar et al., Kayalvizhi et al., 2001 in Spentwash discharged by way of distillery enterprise. This boom in attention also supports the better ph of the soil because of effluent exposure (Sweeney and Grartz., 1991).the increase quantity of sodium ions within the industrial discharge outcomes in precipitation of calcium and magnesium ions. Potassium is a vital nutrient for vegetation to perform various metabolic activities; it needs to be supplied as aspect in fertilizers inside the agricultural fields to satisfy the ok want of potassium within the crop (Johnston, 2003). Despite the fact that it is also said by way of

Ahmed et al., 2012 that the industrial waste enhances the potassium within the soil that's the reason for the impacted soil additionally have correct quantity of potassium similar to un-impacted soil containing fertilizer on this have a look at.

Sodium adsorption ratio (SAR) is the degree of sodicity inside the soil, that's the ratio of the quantity of cationic charge contributed through sodium, to that contributed by way of calcium and magnesium. Soil with excessive levels of sodium however with low ranges of general salt are referred to as sodic which pose harmful effect on flowers. The restriction of SAR in step with Indian trendy is 10 even as typically; SAR above 13 is classified as sodic. (Davis et al., 2012) it is calculated by way of calcium, magnesium and sodium fee in milli equivalent/liter, in our examine SAR fee of each the soils fall within the permissible variety concluding soils to be non sodic.

The CEC is calculated from the degrees of potassium, magnesium, calcium, sodium and hydrogen which had been expected within the soil evaluation and have been located better in S₁ due to presence of accelerated amount of cations inside the soil. These cations have also been reported in sewage, which result a growth in CEC as reported with the aid of Aboulroos et al., (1989). These ions act as pollutants while their amount increases extra than favored fee. They're presupposed to come in contact with the soil because of unplanned launch of untreated fabric discharge within the open field, which additionally increases pH and EC of the soil as examine with the un-impacted soil.

CONCLUSION

The present take a look at aims to bring in notice the dangerous effect of unplanned, non systematic industrialization. It could be concluded by way of the above experimentation that dyes and other pollutants within the textile discharges ended in better pH, electrical conductivity, and water conserving capacity, general hardness and sodium values than the un-impacted agricultural soil. the extraordinarily large differences in soil parameters specializes in instant measures to be taken to deal with the effluents to keep away from their hazardous impact on nature, additionally short measures need to be employed to remediate contaminated soil nearby the Jorbeer industrial area, Bikaner. Thus, soil conservation is a vital step as it will no longer best limit hazards to herbal resources however can even improve the socio- economic condition of people.

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