



Impact of Textile Effluents on Soil in and Around Pali, Western Rajasthan, India

Dushyant Dave and Naresh Vyas

Zoology Department, Department of Science, Jai Narain Vyas University, Jodhpur (Rajasthan) India

ABSTRACT

The study was carried out to investigate the spatial effects of industrial effluents on physico-chemical properties of soil around the textile industrial area of Pali. The analysis of soil became an apparent need for best agriculture practices. Textile industries discharge plenty of pollutants that get mixed up with water bodies. These effluents contain largely alkalis, residual dyes, soluble salts, organic carbons, oils and heavy metals etc. These water bodies are basically the parts of Bandi River. The soil sites near to the end points or nearby points of this river became polluted due to mixing of industrial effluents coming from textile industries located nearby this river. When same wastewater is used for irrigation it adversely affects the soil properties. Disposal of industrial waste is the major problem responsible for soil pollution. The physicochemical analysis of soil was done for one year and present reveals that pH was found more than standard levels and other parameters was found in higher concentration. Thus there is need for treatment of textile effluent before they are discharged into the environment.

Keywords: Textile Industrial Effluents, physicochemical parameters, pollutants, soil etc.

INTRODUCTION

Soil is one of the vital resources on living planet Earth. It is heterogeneous in nature. it plays a significant role in growth of plants sustaining the biome with its natural flora, fauna and indirectly endures the environs. At many places of world including India this textile effluents disposed in rivers are directly utilized for agriculture practices. When such water used for irrigation, increases the level of soil contamination. The use of effluents for irrigating agricultural land is worldwide practice. It is especially common in developing countries, where water treatment cost cannot yet be afforded. the textile processing wastewater is the most polluted sources among all industrial sectors. the effluent released from different textile industries may vary in composition according to their source of production. This textile effluent not only contains the toxic substances but it also has some essential nutrients. Micronutrients are essential nutrients which required in very small quantities for normal plant growth but in textile effluents concentration of these micronutrients became higher due

to continuous accumulation of dyes and other reagent. Essential macro and micronutrient present in effluent may increases the soil fertility but due to the presence of higher concentration of toxic substances it may reduces the soil fertility and adversely affects the nearby agricultural lands. Further presence of higher concentration of pollutants also changed quality of water which does not support the best agricultural yield. Effluents from the textile industries not only manipulate the surface water quality but also affect the underground water and soil productivity. Further, continuous uses of this type of water for irrigation changes the physicochemical properties of soil which affects the agricultural productivity.

MATERIALS AND METHODS

Study area

The study area selected for the present research is located in the Pali. It is located in Western part of Rajasthan, India. Pali is lies between 25.77 degree North latitude to 73.33 degree East latitude. It has the largest number of dyeing

and printing units. The Pali district situated near the bank of Bandi River is highly polluted area as of established textile industries. Bandi river is the major tributary of Luni river and flows in almost east to west direction. bandi river is latitude 25.15 degree and 25.55 degree; longitude 72.56 degree and 73.57 degree. Textile industries located in this area discharge pollutants in Bandi River. This wastewater when used for irrigation affects the quality of the soil of the surrounding area. Study sites are abbreviated as S1 (Mandia Road industrial area, Pali), S2 (Punayta industrial area, Pali), S3 (Naya gaon industrial area, Pali) and S4 (Sardar samand industrial area, Pali).

Sample collection

A total of 36 soil samples were collected from the above

mentioned selected sites (S1-S4) for 9 parameters with the help of hand trowel in plastic bags. These samples were dried in oven for 4-5 hours at temperature 50 ° C. The samples were analyzed for Physico-chemical properties using standard procedures.

Chemical analysis

Collected soil samples were analyzed by studying various parameters like pH, EC, Nitrogen, Phosphorus, Organic carbon, Potassium, Zinc, Iron and Maganese. Analysis of soil sample was done in the central soil and materials research station, Department of water resources, river development and ganga rejuvenation, ministry of Jal shakti, New Delhi. Analysis was carried out as per the standard methods.

Table 1 : Analytical results of selected soil samples of textile effluents with standard for industrial effluents.

Parameter	Site 1	Site 2	Site 3	Site 4	Mean	Standard
pH	9.25	7.28	7.85	8.24	8.15	6.5-7.5
EC $\mu\text{s/cm}$	1.03	1.25	1.33	1.82	1.35	> 1
Nitrogen Kg/ha	185	178	190	169	180.5	250-00
Phosphorus Kg/ha	25.36	21.49	28.96	24.23	25.01	23-56
Organic carbon %	0.25	0.39	0.31	0.41	0.34	0.5-0.75
Pottasium Kg/ha	812.13	623.32	723.14	625.65	696.06	150-300
Zinc mg/kg	0.489	0.569	0.535	0.478	0.517	0.6-1.2
Iron mg/kg	4.652	4.855	4.369	4.758	4.658	4.5
Maganese mg/kg	7.48	8.32	6.25	9.56	7.902	1.0

RESULTS

The analytical results of contaminated soils are given in Table 1 obtained values of the parameters deviated from the permissible limits for pH, EC, Nitrogen, Phosphorus, Organic carbon, Pottasium, Zinc, Iron and Maganese.

pH

Soil pH is one of the most indicative measure of chemical properties of soil. The pH values of collected soil samples vary from 7.28 to 9.25. it suggest that the nature of soil was alkaline. The mean value of pH was 8.15 which is higher than standard.

EC

EC (Electrical conductivity) of soil samples varies from 1.03 to 1.82 $\mu\text{s/cm}$. EC values of the affected soil increased by the increasing concentration of chemical salts released from the textile industries. EC values was higher than standard that means soil samples are highly unsuitable and injurious for plants growth.

Nitrogen

Nitrogen is an essential macronutrient required for stimulating plant growth. It is an important constituent of all fertilizer formulations. Nitrogen is present in the form of nitrate or ammonium which can be easily utilized by plants. Samples investigated in present study contained lower level of nitrogen than standard. It indicates the need of using nitrogen based fertilizer.

Phosphorus

Phosphorus is a major macronutrient for the growth of the plant but excess amounts of phosphorus enhances the formation of algal blooms in water and depresses the soil quality. The total phosphorus found in soils collected from study areas was estimated between 21.49 to 28.96 kg/ha.

Organic carbon

Organic carbon has been used for evaluating fertility status of soil. The values of organic carbon found between 0.25 to 0.41 %. Which was lower than standard (0.5 to 0.75

%). It shows that the soil is unfertile for production due to which, the plants cannot absorb all the available nutrients. Hence, for improvement of soil fertility, it is necessary to add organic manure.

Pottasium

Potassium plays an important role in protein synthesis and maintaining water balance in plant. In this study, potassium was reported in range of 623-812 kg/ha and it was found higher than Standard values.

Heavy metals

The values of zinc in collected soil samples range from 0.478 to 0.569 mg/kg which is lower than standard values (0.6 to 1.2 mg/kg).

The Iron content of collected soil samples ranges from 4.369 to 4.855 mg/kg, the mean value was 4.658 mg/kg which was higher than standard value (4.5 mg/kg).

The manganese is found in collected soil samples in the range between 6.25 to 9.56 mg/kg, the mean value was 7.90 mg/kg which was higher than standard value (1.0 mg/kg).

DISCUSSION

The higher concentration of industrial effluents that mixed up in the soil disturbs negatively the overall physico-chemical properties. The textile wastewater should not directly used for irrigation purpose. The present study highlights that textile discharges mixed up with water and turn it into misfit for irrigation. Moreover, organic pollutants and industrial effluents adversely affect the soil quality. The inherent soil parameters such as phosphorous, potassium, Iron, manganese are found to be in higher magnitudes that make them toxic. Therefore the overall soil fertility decreases. Therefore some suitable approach to detoxify wastewater must be applied for cost effective and economically healthier crop yield.

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