

Physicochemical and Biological Characteristics of Sewage Irrigated Soils in Warangal City, Andhra Pradesh India

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ABSTRACT

The characterization of sewage irrigated soils grown with Paddy crop in Warangal city was undertaken and different physical, chemical and biological characteristics were analyzed. The minimum and maximum range soil temperature 39°C was summer. The soil color was light red and red sandy loam texture. The Water holding capacity and conductivity were maximum during winter. The chemical characteristics PH, total alkalinity, chlorides, calcium, magnesium, calcium carbonate, sulphates, phosphates, nitrates, and organic matter were estimated marginal variation in the chemical constituents were recorded between sewage irrigated and control soils in winter months. Biological parameters like bacterial and fungal colonies were highly recorded in winter months.

Key words: Physicochemical, Sewage irrigated soils, paddy crop, Warangal

INTRODUCTION

Soil is an important as air and water for the sustenance of life for both the plants and the animals. Soil is natural medium of inorganic and organic nutrients and has inbuilt system of spontaneous recycling of matter. Soil pollution decreases the soil fertility and loss of fertility makes this soil inhabitable for plants and other organisms. Soil pollution has adverse effects on soil microbial population that plays important role in soil in formation and keeping it fertile. Soil is one of the important components of natural ecosystem and is not only a store house of nutrients but also moisture for plant growth. Crop growth and yield depends on availability of water which in turn depends on stored water and soil properties, influencing its retention and release. Water retention (sewage) characteristics of soil indicate how best water can be used and managed more efficiently for higher crop productivity thus the present investigation know

water retention characteristics of red soils under different land use ecosystem in relation to physico chemical and biological properties of soil.

MATERIALS AND METHODS

The soils near sewage irrigated agricultural soils (1 to 15) sites were selected, and surface soils samples (0-15cms) depth were collected for physico chemical and biological analysis. One soil sample collected from near paddy agricultural soil served as control soil. Soil sample near Kumarpally which were unpolluted (site no.13 control) and physically similar in nature served as control. The soils were air dried and crushed to small particles in 2mm screen.

Double distilled water and analytical grade chemicals were used for the study. Atomic absorption spectrophotometer (AAS) used for analytical work and instruction manual of the analytical procedures in practical methods in

ecology and environmental science. The physico chemical and biological were analysed as per Trivedi et al (1987).

RESULTS AND DISCUSSIONS

Table 1: Physical Characteristics of Sewage Irrigated Paddy and control soils.

Sites	BD	PS	FC %	WHC %	EC	PWC
1.	1.27	42.6	19.7	23.1	0.96	7.61
2	1.19	51.2	17.9	24.2	0.71	7.01
3.	1.19	47.7	17.6	21.1	0.8	6.71
4	1.01	49.7	17.1	23.4	0.41	7.64
5.	1.28	41.2	15.8	21.6	0.78	6.81
6.	1.02	50.5	16.8	21.2	0.17	7.05
7.	1.02	49.5	16.8	21.8	0.32	7.42
8.	1.21	41.8	16.1	20.3	0.37	6.41
9.	1.01	50.1	15.1	21.2	0.28	6.36
10.	1.06	48.9	17.4	20.6	0.19	6.69
11.	1.09	49.1	16.8	20.8	1.21	7.01
12.	1.28	46.7	14.1	19.7	0.26	6.54
13.	1.36	48.7	13.1	20.6	1.01	7.13
14.	1.28	31.9	17.1	22.6	1.08	6.98
15.	1.24	40.1	18.2	20.8	1.01	6.68

BD: bulk density (gm cm³), %PS: Percentage of pore space, WHC: Water holding capacity CD: conductivity, PWC: Permanent Wilting coefficient

Results during the analysis of the soils samples in the study are represented in Tables 1-3. The characterization of the polluted soil and control soils were same in their texture were analyzed for physical chemical and biological parameters.

The physical characteristics of the soils are utmost important in estimating the productive nature of soil system. The assessment of these characteristics are immense practical value in various soil conservation programs. Physical properties of the polluted sewage irrigated maize soils are compared with control soils. Temperature is one of the most essential parameter in soil. It has significant impact on growth and activity of microorganisms. In addition higher temperature enhances bacterial growth and its metabolic process. Temperature plays a significant role in the reduction of organic content of the effluent. The soil temperature varied from 20°C-29°C. Soil color was light red color, soil texture is sandy loam. No remarkable differences were observed in water holding capacity of both the soils.

Table-2: Chemical Characteristics of Sewage irrigated paddy and control soils

Sites	p ^H	Total Alkalinity mg/100g	Chlorides mg/100g	Calcium mg/100g	Magnisium mg/100g	Calcium Carbonate percentage	Organicmatter Percentage	Sulphates mg/100g
1	6.9	50	26.98	22.23	10.76	29.1	2.99	0.6
2	7.0	56	24.14	42.23	21.03	24.1	2.32	0.8
3	7.1	62	28.4	38.23	18.04	22.4	2.48	1.1
4	6.8	72	25.5	25.13	22.1	36.2	2.48	1.8
5	7.2	48	28.4	28.18	21.3	55.2	2.99	0.6
6	6.9	76	31.2	40.25	20.9	38.2	3.01	0.5
7	7.0	68	31.9	22.4	23.4	30.2	2.94	1.0
8	7.0	92	38.7	23.1	24.2	28.9	3.22	1.2
9	6.8	64	58.2	24.2	26.3	54.2	2.99	1.6
10	7.1	58	48.1	32.1	28.4	48.2	2.42	1.8
11	7.2	54	51.01	29.8	16.8	36.2	3.01	0.9
12	6.9	64	39.2	33.9	20.3	28.9	3.42	1.1
13	7.0	60	32.8	34.8	24.5	30.0	3.56	1.0
14	7.1	58	36.2	38.1	22.5	42.1	2.89	1.01
15	7.0	62	38.1	36.4	24.2	38.1	3.01	1.01

The variations between these two were very meager and average was 22.47% in sewage irrigated maize soils and control soils respectively. The mean conductivity reduced marginally from sewage to 1.91 $\mu\text{Mho}/\text{cm}^3$ to control 0.49 $\mu\text{Mho}/\text{cm}^3$.

Table-3. Bacterial ($\text{IX } 10^6\text{g}$), Fungal ($\text{IX}10^5\text{g}$), Actinomycetes ($\text{IX}10^6\text{g}$), colonies in Sewage irrigated paddy and control soils.

Sites	Bacteria	Fungi	Actinomycetes
1	45	21	23
2	58	23	23
3	45	18	35
4	64	19	31
5	62	23	29
6	65	24	41
7	53	21	28
8	47	19	30
9	41	18	32
10	51	31	29
11	59	41	30
12	53	28	38
13	42	31	28
14	46	26	29
15	45	28	31

Chemical characteristics were analyzed and presented in table-2. The chemical characteristics of the soil pH was observed in the range of 7.0 to 8.0. This indicates the soils are alkaline while the soils in Kumarpally are always 7.0 neutral in nature. Chemical activity and biological effect of sludge borne heavy metals and in organic metal salts to soils was analyzed. The chemicals in the soils also effect the activities of soil microorganisms which play in important role in the soil assessed based and means of accumulation of the toxic chemicals in the soils around various sewages in India Sughag et al (2007). Studied about the effect of chemical fertilizers vs composed on fertility, Soil texture and micro flora with special reference to certain crops. The fluctuations in chemical properties between polluted and control was recorded in figures 1-9. The average total alkalinity was high in sewage irrigated maize soils and 1.4 mg/10g

and low in 0.4mg/ 10g in control soils. The chloride content fluctuated from 14.2mg/10g (site no.5) to 222.72mg/10g (site no.2) sewage and 10.4mg/10g in control soil. The calcium and magnesium content were high in sewage soils while decreased substantially in control soils Menon et al (1988) and Malik et al (2007). Sodium and potassium also showed their decrease in amounts in control soils over contaminated soils (Demerdashe, 1995) the soil nutrients such as sulphates, phosphates, and nitrates were detected in high concentration in the sewage irrigated soil while phosphates were exceptionally high in 242.0mg/10g in site no. 12. Mandal et al (2006), Mishra Roy and Paul et al. (2007) the nitrates also showed significant variations during in sewage and control soils. The organic matter content high in 4.03% site no 1, low in site no.1.4.04% Malik et al (2007) soils contaminated sewage and other effluents and other recorded direct correlation between crop productivity and loads of chemical contaminants.

Microorganisms, the efficient decomposers enumerated in both polluted and control soils and presented in Table 3. It was noticed that the fungal high population recorded in sewage grown with maize soils at site no.2 23×10^5 , and 9×10^5 in site no.13 control soil. The bacterial population was recorded high 23×10^6 in sewage site no.12. Salakinkop et al (2012) critically observed the production and characterization of enriched urban waste composts and their influence on crop productivity. Tekade (2007) studied the determination of available micro nutrients present in the soil and study of their effects on the crops. Ram Prakash (2008), Patra et al (2006), Sis and Dutta (2006) Karsma Jumder et al (2007) also studied nitrogen mineralization some added organic manures in soils. The influence of sewage irrigated soils, the germination of seed such as *Oriza sativa*, *Zea mays* crops were also noted the percentage of germination was drastically reduced plant growth and crop yield compared to less in other agriculture soils.

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