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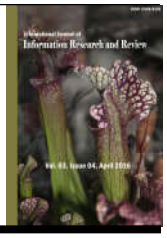

Research Article

CHEMO TOXICITY INVESTIGATION AND PHYSICO CHEMICAL ANALYSIS OF COMPOSITE SAMPLES OF CHEMICAL WASTE EFFLUENT WITH SOIL

Dr. Rajesh Mehta, *Parul Kumar and Dr. Sandeep Goyal

Department of Chemistry, Govt. National College, Sirsa (125055)

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ABSTRACT

Soil degradation from various inorganic and organic contaminants, is not only an ecological risk, but simultaneously it is also a Socio-economic issue, such soils become poor in physicochemical properties, susceptible to erosion, loss of productivity, sustainability and diminished food chain quality. Soil samples were collected from different areas near Kaliasote dam of Bhopal city (M.P.) at 0-25cm depth for analysis. These sites were selected in each area for collection of soil samples from ten different locations. Analysis were carried out for selected parameters i.e. pH, electric conductance, organic carbon, total nitrogen, CaO, Mn, Zn and Mo etc. Results indicate the variation in parameters during the year 2006-2007. The study concluded that the continuous application of effluent appears to deteriorate soil quality in the area.

INTRODUCTION

Soil is one of the vital resources on living planet Earth. It is heterogeneous in nature. 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. Irrigation with sewage effluents provides with water, nitrogen (N) and phosphorus (P) as well as organic matter to the soil. All these have beneficial effects on soil biota, at the same time it provides a convenient mean of sewage disposal through land treatment, preventing potential health and environmental hazards, caused by the uncontrolled flow of waste water. Wastewater is a valuable source of plant nutrients and organic matter needed for maintaining fertility and productivity levels of the soil[1]. With respect to both the quantity and composition, the textile processing wastewater is recorded as the most polluted sources among all industrial sectors[2]. Many scientists have documented adverse effects of different industrial effluents on the growth of plants dye waste water has also been found toxic to several crop plants. The present investigation was aimed to know the effect of dye industrial effluent on soil quality.

Why Test Soil?

Soil testing may be carried out for various purposes. Its main uses include:

- Assessment of land capability for various forms of agriculture,
- Identifying and quantifying soil constraints (e.g. salinity),
- Monitoring of soil fertility levels.
- Providing guidelines as to the type and amount of fertiliser to be applied for optimum plant growth on the particular site and
- As a diagnostic tool to help identify reasons for poor plant performance.

Basic Requirements

There are three basic steps that must be followed if meaningful results are to be obtained from soil testing. These are:

- To take a representative sample of soil for analysis,
- To analyze the soil using the accepted procedures that have been calibrated against fertilizer experiments in that particular region and
- To interpret the results using criteria derived from those calibration experiments.

Soil analysis provides information which can be used to improve soil fertility through management. The extent to which soil fertility can be improved depends on the inherent properties of the site – soil texture, mineralogy, slope and climate. Soil structure is also key to plant performance as it affects the ability of plant roots to access available nutrients.

Corresponding author: Parul Kumar,
Department of Chemistry, Govt. National College, Sirsa (125055).

During Pre Monsoon

S.No.	Parameter	Unit	Sampling Stations									
			1	2	3	4	5	6	7	8	9	10
1	pH	-	5.5	5.3	5.7	5.8	5.6	5.2	5.8	5.9	5.8	5.2
2	Ele.cond.	%	0.10	0.10	0.09	0.08	0.09	0.07	0.08	0.09	0.09	0.08
3	Water holding capacity	%	36	32	39	40	37	29	25	22	39	34
4	Fe_2O_3	%	5.63	5.10	4.93	3.90	5.39	6.31	5.21	6.41	5.93	5.89
5	P_2O_5	%	0.16	0.17	0.18	0.19	0.16	0.20	0.19	0.14	0.15	0.19
6	CaO	%	1.18	1.23	1.39	1.21	1.43	1.29	1.31	1.43	1.51	1.32
7	Organic carbon	%	0.80	0.73	0.75	0.67	0.74	0.72	0.70	0.69	0.65	0.71
8	Total Nitrogen	%	0.039	0.037	0.036	0.030	0.037	0.031	0.026	0.029	0.026	0.020
9	Manganese	Mg/l	1.09	1.03	0.93	0.98	1.39	1.52	0.97	1.31	1.18	1.05
10	Zinc	Mg/l	5.5	5.9	6.5	6.9	5.3	5.1	4.9	5.9	5.8	4.2
11	Molybdenum	Mg/l	4.5	4.9	5.2	4.3	3.9	4.9	5.3	6.5	4.8	3.9
12	Boron	Mg/l	0.26	0.25	0.21	0.19	0.25	0.29	0.21	0.17	0.18	0.19
13	Cadmium	Mg/l	0.48	0.40	0.31	0.59	0.61	0.39	0.34	0.43	0.49	0.48
14	Lead	Mg/l	0.29	0.26	0.19	0.23	0.35	0.32	0.39	0.36	0.31	0.27

During Monsoon

S.No.	Parameter	Unit	Sampling Stations									
			1	2	3	4	5	6	7	8	9	10
1	pH	-	5.8	6.1	6.4	6.5	6.3	5.8	6.5	6.6	6.5	5.8
2	Ele.cond.	%	0.10	0.11	0.10	0.09	0.10	0.08	0.09	0.10	0.10	0.09
3	Water holding capacity	%	28	36	44	46	30	21	28	25	44	38
4	Fe_2O_3	%	6.31	5.71	5.52	4.37	6.04	7.07	5.84	7.18	6.64	6.60
5	P_2O_5	%	0.21	0.19	0.20	0.21	0.18	0.26	0.21	0.16	0.17	0.21
6	CaO	%	1.32	1.38	1.56	1.36	1.60	1.44	1.47	1.60	1.69	1.48
7	Organic carbon	%	0.34	0.32	0.28	0.30	0.27	0.26	0.22	0.30	0.39	0.44
8	Total Nitrogen	%	0.044	0.041	0.040	0.034	0.041	0.035	0.029	0.032	0.029	0.022
9	Manganese	Mg/l	1.22	1.15	1.04	1.10	1.56	1.70	1.09	1.47	1.32	1.18
10	Zinc	Mg/l	6.2	6.6	7.3	7.7	5.9	5.7	5.5	6.6	6.5	4.7
11	Molybdenum	Mg/l	5.0	5.5	5.8	4.8	4.4	5.5	5.9	7.3	5.4	4.4
12	Boron	Mg/l	0.29	0.28	0.24	0.21	0.28	0.32	0.24	0.19	0.20	0.21
13	Cadmium	Mg/l	0.54	0.45	0.35	0.66	0.68	0.44	0.38	0.48	0.55	0.54
14	Lead	Mg/l	0.32	0.29	0.21	0.26	0.39	0.36	0.44	0.40	0.35	0.30

Post Monsoon

S.No.	Parameter	Unit	Sampling Stations									
			1	2	3	4	5	6	7	8	9	10
1	pH	-	6.4	6.9	6.2	6.3	6.1	5.7	6.3	6.4	6.3	5.7
2	Ele.cond.	%	0.10	0.11	0.10	0.09	0.10	0.08	0.09	0.10	0.10	0.09
3	Water holding capacity	%	27	35	43	45	29	21	27	24	43	37
4	Fe_2O_3	%	6.14	5.56	5.37	4.25	5.88	6.88	5.68	6.99	6.46	6.42
5	P_2O_5	%	0.21	0.19	0.20	0.21	0.17	0.25	0.21	0.15	0.16	0.21
6	CaO	%	1.29	1.34	1.52	1.32	1.56	1.41	1.43	1.56	1.65	1.44
7	Organic carbon	%	0.33	0.32	0.27	0.29	0.26	0.25	0.22	0.29	0.38	0.43
8	Total Nitrogen	%	0.043	0.040	0.039	0.033	0.040	0.034	0.028	0.032	0.028	0.022
9	Manganese	Mg/l	1.19	1.12	1.01	1.07	1.52	1.66	1.06	1.43	1.29	1.14
10	Zinc	Mg/l	6.0	6.4	7.1	7.5	5.8	5.6	5.3	6.4	6.3	4.6
11	Molybdenum	Mg/l	4.9	5.3	5.7	4.7	4.3	5.3	5.8	7.1	5.2	4.3
12	Boron	Mg/l	0.28	0.27	0.23	0.21	0.27	0.32	0.23	0.19	0.20	0.21
13	Cadmium	Mg/l	0.52	0.44	0.34	0.64	0.66	0.43	0.37	0.47	0.53	0.52
14	Lead	Mg/l	0.32	0.28	0.21	0.25	0.38	0.35	0.43	0.39	0.34	0.29

Soil analysis is important in organic farming for nutrient management planning (e.g. rotational plans, making best use of manures, fertilizer application), to prevent long term nutritional and health problems (crop and livestock), prevention of pollution and for derogations for use of restricted inputs. A one-off soil analysis simply provides a snapshot of nutrient availability at a particular time. Soil analysis should be repeated at regular intervals to identify trends in nutrient availability and adjust nutrient management accordingly. The soil analysis itself is only the first step. Specialist interpretation and recommendations are equally important. Soil analysis should be interpreted in rotational context. Large quantities of nutrients can be exported when selling a single crop, e.g. potash in potatoes. Interpretation should take account of the local conditions and crop; it may not be cost effective to set the same targets for lowland as for upland sites. Use annual soil analysis from one or two representative fields alongside nutrient budgets to track soil fertility changes over time.

MATERIALS AND METHODS

The objectives of the present study is to analyze the physicochemical properties of soil which can help in identification of environmental impacts. Soil samples were collected from theselected land and untreated chemical effluent is used for irrigation purpose. Three replicates of each sample from ten different locations were collected from 0-25cm depth.

Composite sample for each replicate were prepared, air-dried, gently crushed with a wooden roller and passed through 2mm sieve. Sieved soil samples (<2 mm) were stored in plastic bags for further analysis. The collected effluent samples have been analyzed to determine its physicochemical parameters. The soil samples were collected during the 2006-2007. Temperature and pH were recorded on the field. The soil samples have been analyzed for pH, electrical conductivity (EC); water holding capacity (WHC); percent organic carbon (OC); and various other parameters. Physicochemical parameters of soil samples were analyzed by standard protocol[3-4].

RESULTS AND DISCUSSION

The tables below show the variation in the physico chemical parameters of the soils during 2006-07.

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